Online ISSN : 2249-4626
Print ISSN : 0975-5896
DOI : 10.17406/GJSFR

Global Journal

of Science Frontier Research: B

Chemistry

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Discovering Thoughts, Inventing Future

VERSION 23 ISSUE 2 VERSION 1.0

Global Journal of Science Frontier Research: B
Chemistry

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Chemistry

Volume 23 Issue 2 (Ver. 1.0)

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Global Journal of Science Frontier Research

Contents of the Issue

Global Journal of Science Frontier Research: B Chemistry
Volume 23 Issue 2 Version 1.0 Year 2023
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Unveiling Chiral Discrimination in Helically Chiral Diastereomers through Reversed Phase HPLC: Insight from Induced Herical Chiralty

By Hiroshi Ohrui
Yokohama University

Abstract- The most reliable and widely used diastereomer method in chiral discrimination has a fatal problem in that it is impossible to discriminate the diastereomers having chiral centers separated by more than 4 bonds. The problem has been assumed to be intrinsic to the diastereomer method and therefore very difficult to solve. In order to solve the problem, we have developed highly potent chiral discrimination methods by use of helically chiral derivatization reagents (for example A, Fig. 1)1). A has an anthracene-2,3-dicarboximido group on one side (wing) and OH or COOH group for derivatization on the other side (wing). The anthracene-2,3-dicarboximodo group is for highly sensitive fluorescence and long-distance anisotropy for 1H-NMR study.

GJSFR-B Classification: *LCC: QD261-272*

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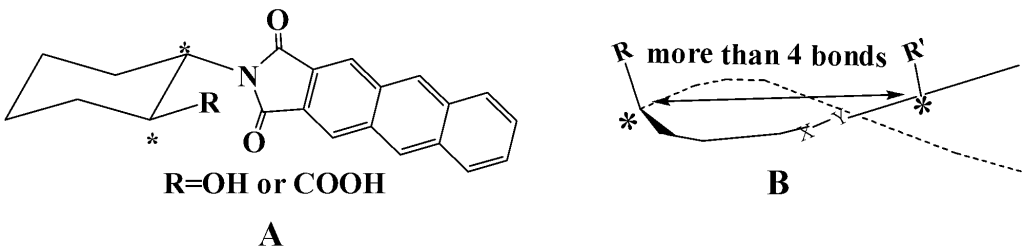

Fig. 1

The helically chiral diastereomer derivatized with *A* and a chiral sample does not have the distance problem of two chiral centers because it has only the chiral center derived from the sample. For example, the helically chiral diastereomer *B* (Fig. 1) (derivatized with a helically chiral reagent and a chiral sample having one chiral center) has only one chiral center caused by *R*' that is derived from the sample, and therefore, *B* does not have the distance problem. (The chiral center caused by *R* in *B* is the one to make the derivatization reagent helically chiral and does not interfere with chiral discrimination.) Therefore, it is expected that the helically chiral diastereomers derivatized with *A* could be discriminated by some means. In fact, the helically chiral diastereomers (and stereoisomers) derivatized with *A* can be separated by reversed phase HPLC[1, 2], and *A* has been proved to be the most powerful Mosher reagent for ^{1}H-NMR study.[1, 3c)] The absolute configurations of many natural products have been determined by the HPLC or ^{1}H-NMR methods.[1, 3)]

However, the question "*Why can the helically chiral diastereomers (and stereoisomers), especially those having far remote chiral center(s), be separated by the achiral reversed phase HPLC?"* has remained to be answered.

In this paper, I would like to submit an answer for the question by citing the separation of anteiso fatty acids derivatized with *A* as an example (Fig. 2).

I hope that the answer could attract much attention and contribute to the further development of chiral discrimination method.

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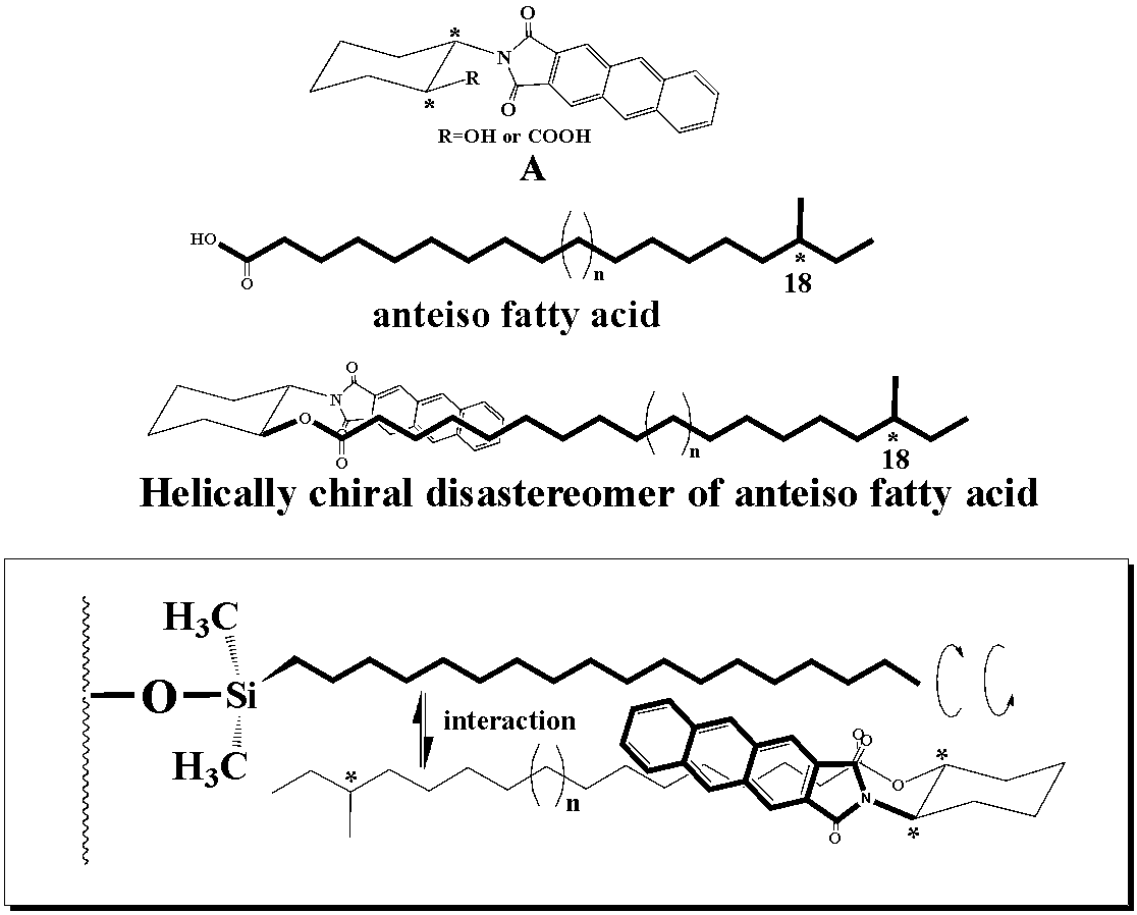

Fig. 2

We showed that the helically chiral diastereomers derivatized with *A* and anteiso fatty acids up to 21:0 (methyl branching at C18) could be separated by ODS (18 methylene chain) column and those over 18-branching ones could not be separated by ODS column, but they could be separated by C30 column (30 methylene chain)[1, 4] (Fig. 3).

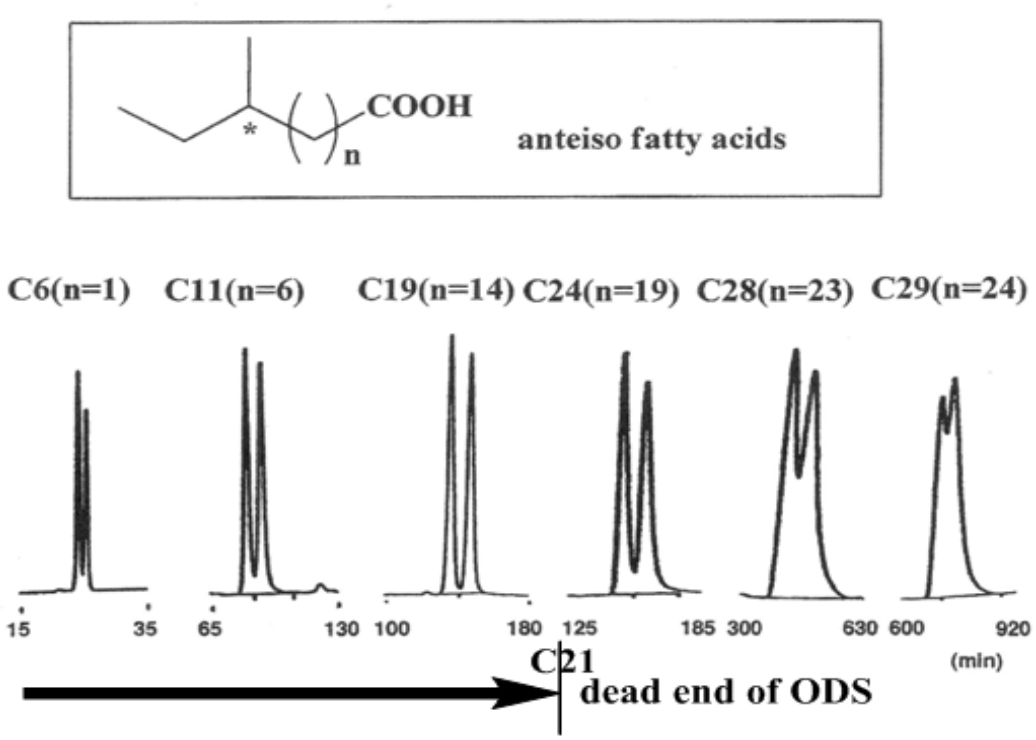

Fig. 3: HPLC Chromatogram of the Helically Chiral Diastereomers of Anteiso Fatty Acids Derivatized With *A* By C30 Column

These results indicate that

1. The methylene chain length of the reversed phase column is important for the separation,
2. Both of the column methylene chain and the diastereomer's methylene chain are straight and interact in a liner way with each other,
3. A Methylene chain of the column must interact with the two chiral positions (one is the position that tells the helical chirality of the diastereomer and the other is that of methyl branching) of the diastereomer simultaneously so that it gets the two information of the chirality of the diastereomer at the same time.

Now, a new question *"How can one chiral information of the diastereomer be transmitted to the other interaction position through the methylene chain?"* arises.

Here, I would like to propose an idea of "*induced helically chiral methylene chain"*.

The methylene chain of the column is twisted clockwise or counterclockwise depending on the helical chirality of the diastereomer by the interaction with the helically chiral diastereomer, this makes the methylene chain helically chiral. (The difference in affinity for the methylene chain of the column between the anthracene-2,3-dicarboximido group and the alkyl ester group of the diastereomer would be playing an important role for the twisting.) Thus, the information of the helical chirality of the diastereomer can be transmitted throughout the methylene chain as the helical chirality of the methylene chain. The helically chiral methylene chain interacts with the chiral center at the methyl branching of the diastereomer. The interaction is different by the (*R*)- or (*S*)-stereochemistry of the chiral center, and therefore chiral discrimination takes place. The chiral discrimination takes place over and over again throughout the column resulting in the separation of the diastereomers.

In conclusion, the normally achiral reversed phase column is changed into a chiral column by the interaction with the eluate.

Acknowledgement

The author would like to dedicate this paper to his two deceased mentors, Dr. Masanao Matsui and Dr. Kenji Mori.

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Global Journal of Science Frontier Research: B Chemistry
Volume 23 Issue 2 Version 1.0 Year 2023
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Dispersion Devices using a Fourier Analyzer

By V. Kozubovskyi & Yu. BIlak
Uzhhorod National University

Abstract- The paper considers the possibility of optimizing the parameters of dispersion devices for gas analysis, which use correlation reception of the useful signal and are used for the analysis of gas mixtures in the visible and UV regions of the spectrum. The factors affecting the optimal filtering of the useful signal in the electronic path of the device are determined, and methods of eliminating this influence, including the background component of the signal, are proposed. As an example of the use of gas analysis devices with correlated selection of a useful signal in the electronic path of the analyzer, the structural diagram of the device for the analysis of SO2 in the gases of thermal power plants is described.

Keywords: gas analyzer; correlation signal selection; electronic channel.

GJSFR-B Classification: FOR Code: 030101

Strictly as per the compliance and regulations of:

Dispersion Devices using a Fourier Analyzer

ДИСПЕРСІЙНІ ПРИЛАДИ З ВИКОРИСТАННЯМ ФУР'Є АНАЛІЗАТОРА

V. Kozubovskyi [α] & Yu. Bllak [σ]

Abstract- The paper considers the possibility of optimizing the parameters of dispersion devices for gas analysis, which use correlation reception of the useful signal and are used for the analysis of gas mixtures in the visible and UV regions of the spectrum. The factors affecting the optimal filtering of the useful signal in the electronic path of the device are determined, and methods of eliminating this influence, including the background component of the signal, are proposed. As an example of the use of gas analysis devices with correlated selection of a useful signal in the electronic path of the analyzer, the structural diagram of the device for the analysis of SO2 in the gases of thermal power plants is described.

Keywords: gas analyzer; correlation signal selection; electronic channel.

Абстрактный: **В роботі розглянута можливість оптимізації параметрів дисперсійних приладів газового аналізу, які використовують кореляційний прийом корисного сигналу і застосовуються для аналізу газових сумішей у видимій та УФ областях спектру. Визначено фактори, які впливають на оптимальну фільтрацію корисного сигналу в електронному тракті приладу, запропоновано методи усунення цього впливу, в тому числі і фонової складової сигналу. Як приклад використання приладів газового аналізу з кореляційним виділенням корисного сигналу в електронному тракті аналізатора описана структурна схема приладу для аналізу SO_2 у газах теплових електростанцій.**

I. Вступ

За зведеними даними по Україні основними забруднювачами атмосфери міст є пил і викиди автотранспорту — в основному важкі вуглеводні, формальдегід, бензопірен, діоксид азоту, а також важкі метали. Адже саме ці речовини, за словами лікарів, є одними з основних збудників онкологічних захворювань.

Серед інших причин забруднення повітря міст фахівці називають скорочення площі зелених насаджень. Забезпечення надійного та однозначного контролю викидів небезпечних речовин у навколишнє середовище є одним з найбільш актуальних завдань для екології.

Серед методів контролю викидів газоподібних речовин найбільш перспективними і широко вживаними методами є оптичні абсорбційні методи. Вони демонструють високу точність, надійність метрологічних параметрів, хороші експлуатаційні характеристики.

Для підвищення селективності абсорбційних оптичних приладів часто використовуються методи кореляційного аналізу.

Останнім часом стали широко використовувати кореляційні типи приладів з виділенням корисного сигналу в електронному тракті. Вони основані на скануванні з великою частотою вузького спектрального діапазону (20-40) нм, у якому перебувають смуги поглинання досліджуваних газів, що мають характерну структуру і дозволяють ідентифікувати велику кількість газових компонентів, лінії поглинання яких лежать в межах області спектра, що сканується і мають характерну структуру внаслідок коливальних (для УФ області спектру) або обертальних (для ІЧ області) рухів молекули. Такі прилади, як правило, використовують для наукових досліджень при вивченні процесів, що швидко протікають [1]. Сканування спектру здійснюється швидким переміщенням дифракційної решітки, поворотного дзеркала монохроматора, плоско-паралельної пластини, встановленої на шляху його променів, вихідної щілини монохроматора [2]. При детектуванні спектру, що сканується за допомогою фотоприймача, періодичний електричний сигнал тієї або іншої форми в залежності від наявності газу, що визначається в атмосферному повітрі, надходить у систему реєстрації. Ідентифікація газових компонентів за характерними особливостями періодичного сигналу проходить найчастіше за рахунок формування синхроімпульсів, які поступають в систему реєстрації з визначеною частотою в залежності від періоду структури досліджуваного газового компонента [3,4,5]. Однак можливий і інший шлях - фільтрація корисного електричного сигналу в системі реєстрації за допомогою нечутливих до зміни форми сигналу фільтрів [6]. На цьому принципі були створені прилади для аналізу SO_2 в газоподібних викидах теплових електростанцій і NH_3 при технологічних процесах [7,8].

Електронні смуги поглинання, наприклад, SO_2 мають яскраво виражену характерну коливальну структуру (див.рис.1). Тому у вихідній площині поліхроматора, при наявності в робочій кюветі SO_2, буде спостерігатися спектр SO_2 у вигляді "світлих" і "темних" смуг, що чергуються (в максимумах поглинання спектру випромінювання послаблюється, в мінімумах - залишається без істотних змін). При скануванні цього спектру з частотою ω_p за

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допомогою, наприклад, нарізаних на обертовому диску радіальних вихідних щілин (число щілин вибирається з умови, щоб у зоні сканування в кожний момент часу знаходилася тільки одна щілина), на виході фотоприймача (фотоелектронного помножувача - ФЕП) з'являється електричний сигнал з певною "резонансною" для SO_2 частотою ω_o. Амплітуда цього електричного сигналу пропорційна концентрації SO_2.

Частота ω_o залежить від частоти сканування ω_p і кількості n ліній поглинання на ділянці спектру аналізованого газу (див.рис.1).

Співвідношення цих частот $\omega_o/\omega_p = n$. В електронному тракті приладу здійснюється фільтрація отриманого сигналу. Як видно з рис.1, сигнал має складову з частотою ω_p , пов'язану з наявністю інтегрального поглинання випромінювання, яке збільшується зі зменшенням довжини хвилі.

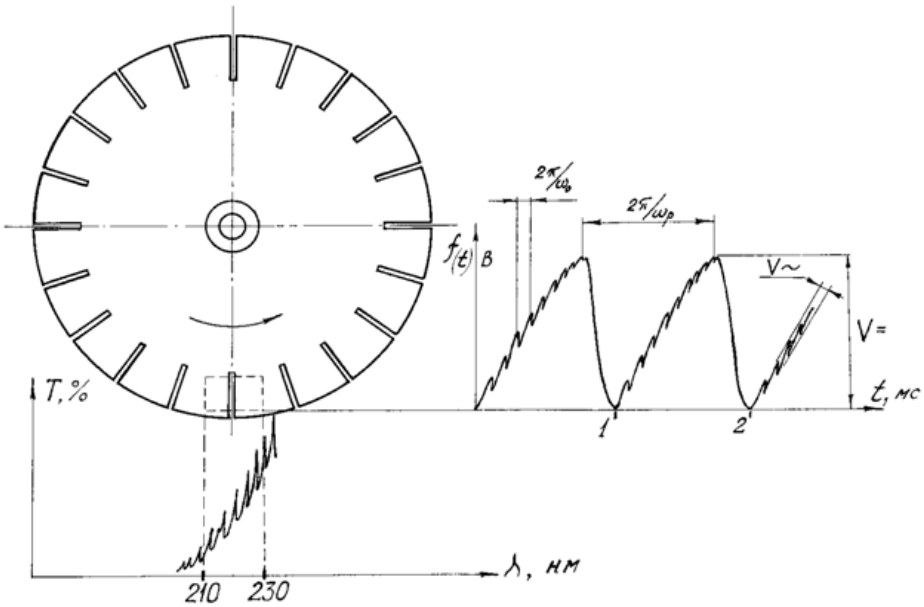

Рис. 1: Сканування спектру поглинання SO_2 у вихідній площині спектрометра за допомогою вихідної щілини, що обертається

Тому корисний сигнал на частоті ω_o спостерігається на фоні пилкоподібного сигналу з частотою ω_p. Амплітуди $I_{\omega o}$, $I_{\omega p}$ обох частотних складових залежать від інтенсивності світлового потоку, що надходить на фотоприймач, від величини інтегрального поглинання аналізованим газом, неселективних втрат випромінювання. Амплітуда сигналу на частоті ω_o залежить ще й від величини диференціального поглинання в лініях тонкої структури спектру. Таким чином, відношення амплітуд сигналів $I_{\omega o}/I_{\omega p}$ визначається тільки диференціальним поглинанням випромінювання аналізованим газовим компонентом і не змінюється при варіаціях інтенсивності джерела випромінювання, неселективних втрат, зміні рівня інтегрального поглинання за рахунок наявності, наприклад, газових компонент, що заважають.

На рис.2 наведені ділянки спектрів NO, NH_3, SO_2 в області 200-230 нм і NO_2 в області 430-450 нм. Як бачимо, спектри мають характерну структуру. Ділянки спектрів NO, SO_2, NH_3 знаходяться на краю інтенсивних електронних смуг поглинання, тому інтегральне поглинання значно змінюється зі зменшенням довжини хвилі. Одержані в результаті розрахунків гармонічні склади часових сигналів, що знімаються з фотоприймача при скануванні, наведені на рис.2.а, ділянки відповідних спектрів зображені на рис. 2.б. Отримані розрахункові залежності перевірялися експериментально за допомогою скануючого з великою ω_o ділянки (наприклад, NH_3, SO_2) у спектрі електричного сигналу присутні дві основні гармоніки - перша відповідає частоті ω_p, і друга (n-та) - ω_o, де n - кількість ліній поглинання на сканованій ділянці спектру. Так, при скануванні ділянки спектру NH_3 200-220 нм частота ω_o відповідає п'ятій гармоніці, і дев'ятій гармоніці (n = 9) при скануванні ділянки 210-225 нм SO_2. Якщо ж сканується не ціле число періодів структури спектру, наприклад n = 4,5, то інтенсивними є 4 і 5 гармоніки спектру електричного сигналу.

Для NO на спектральній ділянці 200-230 нм спостерігається всього 3 вузьких піки поглинання. Однак, оскільки лінії поглинання мають вигляд дельта-функцій, то окрім 3-ої гармоніки спостерігається ряд інтенсивних більш високих гармонік.

У разі ж NO_2 на ділянці 433-450 нм знаходяться найбільш інтенсивні чотири лінії

поглинання, ширина і форма яких різна і тому поряд з гармонікою $n = 4$ спостерігається ряд інтенсивних більш високих гармонік.

Отже, у разі аналізу газових компонентів з аперіодичною структурою спектра (наприклад, NO_2), або з ширинами ліній поглинання значно меншими періоду структури (лінії поглинання NO мають вигляд дельта-функцій) спектр електричного сигналу, що знімається з фотоприймача є досить складним і містить низку гармонік.

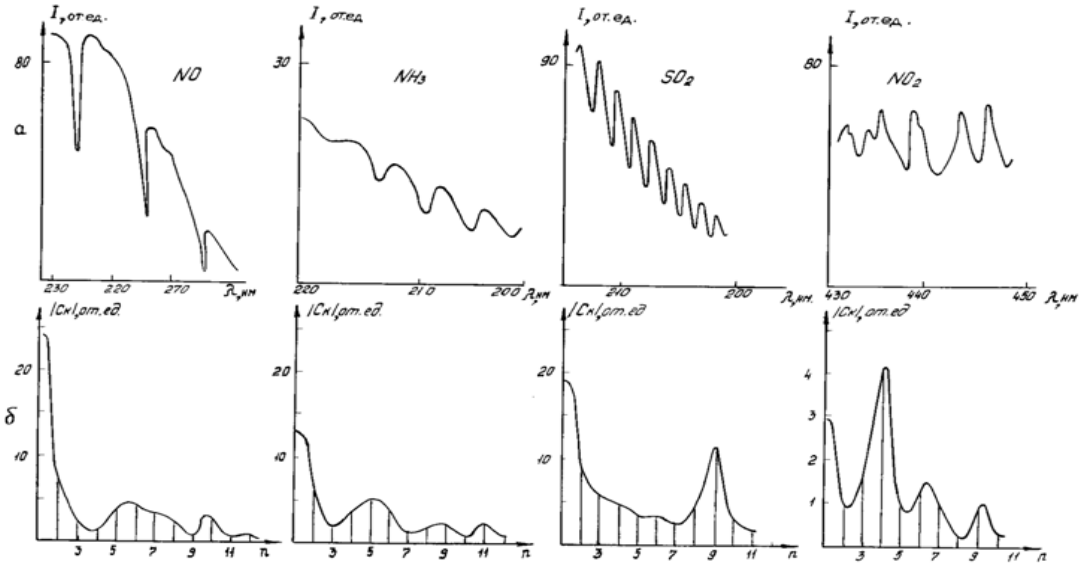

Рис. 2: Залежність світлового потоку від довжини хвилі у вихідній площині спектрометра для різних газів (а) та спектри електричних сигналів, що знімаються з фотоприймача спектрометра при скануванні вихідної щілини (б)

Якщо ж структура спектру має хорошу періодичність (SO_2, NH_3), то спостерігається, в основному, тільки одна n-та гармоніка, амплітуда якої залежить від концентрації аналізованого компонента в газовій суміші.

Вплив на спектр корисного сигналу параметрів сканuючого спектрометра.

Досліджувався вплив на гармонічний склад корисного сигналу зміни ширини щілин скануючого монохроматора, концентрації досліджуваного газу, зміщення в площині вихідної щілини спектру досліджуваного газу, вибору ширини ділянки спектру, що сканується. Як буде показано нижче, всі ці параметри мають істотний вплив на гармонічний склад і величину корисного сигналу.

Експериментальна установка складалася з освітлювача на основі дейтерієвої лампи ДДС-30 (оптичної лампи ОП8-9), кварцової кювети довжиною L = 100мм, монохроматора МДР-3 зі зворотною лінійною дисперсією 1,3 нм/мм в області (0,2-0,6) мкм, фотоприймача ФЕП-142 (ФЕП-86) підключеного до самописця через узгоджувальний підсилювач.

У кювету напускалися газові суміші NH_3 в азоті різної концентрації.

Зміна ширини вхідної і вихідної щілини монохроматора. Ширина щілин змінювалась у межах від 0,1 до 0,25 мм. Концентрація в кюветі дорівнювала 1000 млн$^{-1}$. При цьому спектральна ширина щілин була значно менше періоду $Д$ структури спектру поглинання NH_3. У таких умовах знімався спектр поглинання NH_3 в області від 190 до 230 нм. Для розрахунків вибиралась ділянка спектру (200-220) нм і визначався гармонійний склад корисного сигналу при послідовному скануванні цієї ділянки.

Результати розрахунків наведено на рис. 3. Як бачимо, при збільшенні ширини щілин величина корисного сигналу (6-ої гармоніки) збільшується. Збільшується і відношення амплітуд гармонік $|C_6|/|C_1|$, величина $[|C_6| - (|C_5| + |C_7|)/2]/|C_1|$, тобто корисний сигнал з врахуванням фонової складової, віднесеної до основної гармоніки частоти сканування.

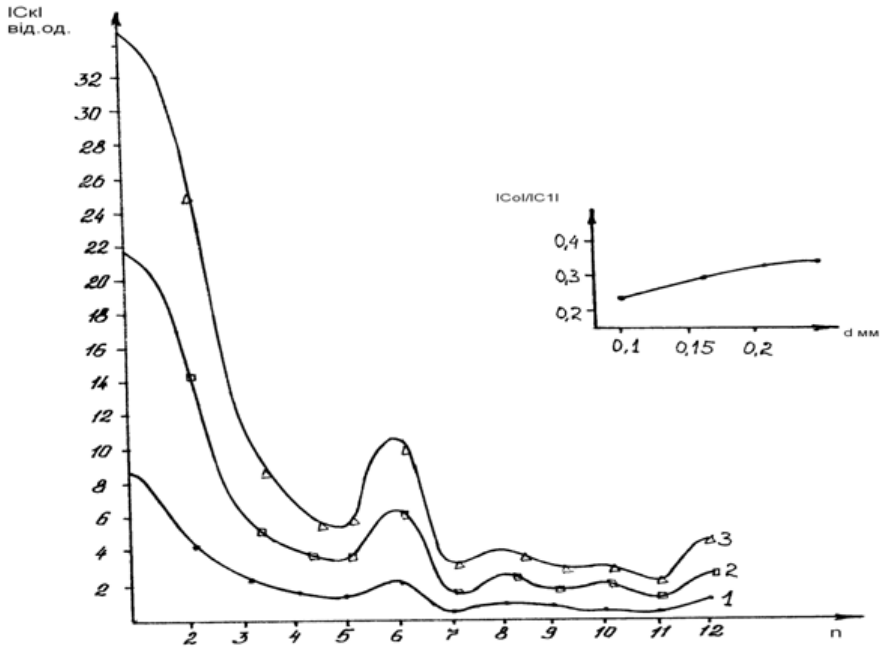

Рис. 3: Зміна амплітуд гармонік електричного сигналу при зміні ширини d вхідної и вихідної щілин скануючого спектрометра

До яких же меж необхідно збільшувати ширину щілин? Спектральна ширина щілин повинна бути:

$d\lambda=0,5Д$ для досягнення максимальної величини сигналу;

{ (1)

$d\lambda=0,37Д$ для отримання максимального відношення сигнал/шум (СШВ).

Підставляючи параметри спектру поглинання NH_3 і монохроматора МДР-3 у вираз для спектральної ширини щілин [9]:

$$d\lambda=D_e\Delta x, \quad (2)$$

де D_e - зворотна лінійна дисперсія, і враховуючи (2), отримаємо оптимальне значення геометричної ширини щілин:

$$\Delta x_{max}=1.5мм;\ \Delta x_{сшв}=1.15мм.$$

Тобто збільшення до цих меж ширин вхідної і вихідної щілин буде приводити до зростання величини корисного сигналу (ширини вхідної і вихідної щілин зазвичай вибирають рівними).

Зміна гармонічного складу корисного сигналу при збільшенні концентрації досліджуваного газу. В газову кювету послідовно напускались концентрації NH_3 рівні x_1 = 250 млн$^{-1}$, x_2 = 800 млн$^{-1}$, x_3 =1600 млн$^{-1}$. Для кожного значення концентрації знімався спектр у діапазоні довжин хвиль від 190 до 230 нм і за допомогою перетворення Фур'є визначався гармонічний склад корисного сигналу. Результати експерименту наведено на рис. 4. Як видно з рис. 4, зі збільшенням концентрації досліджуваного газу максимум розподілу гармонік корисного сигналу зміщується в бік більш низькочастотних гармонік.

Це, мабуть, пов'язано з тим, що зі збільшенням концентрації досліджуваного газу лінії поглинання ширшають і структура спектру NH_3 стає ближчою до синусоїдальної, що і призводить до зменшення вкладу високочастотних гармонік в корисний сигнал.

З наведеного експерименту випливає, що для вимірювання концентрації досліджуваного газу в широких межах необхідно детектувати корисний сигнал на декількох близьких гармоніках, пов'язаних з наявністю структури смуги поглинання досліджуваного газу.

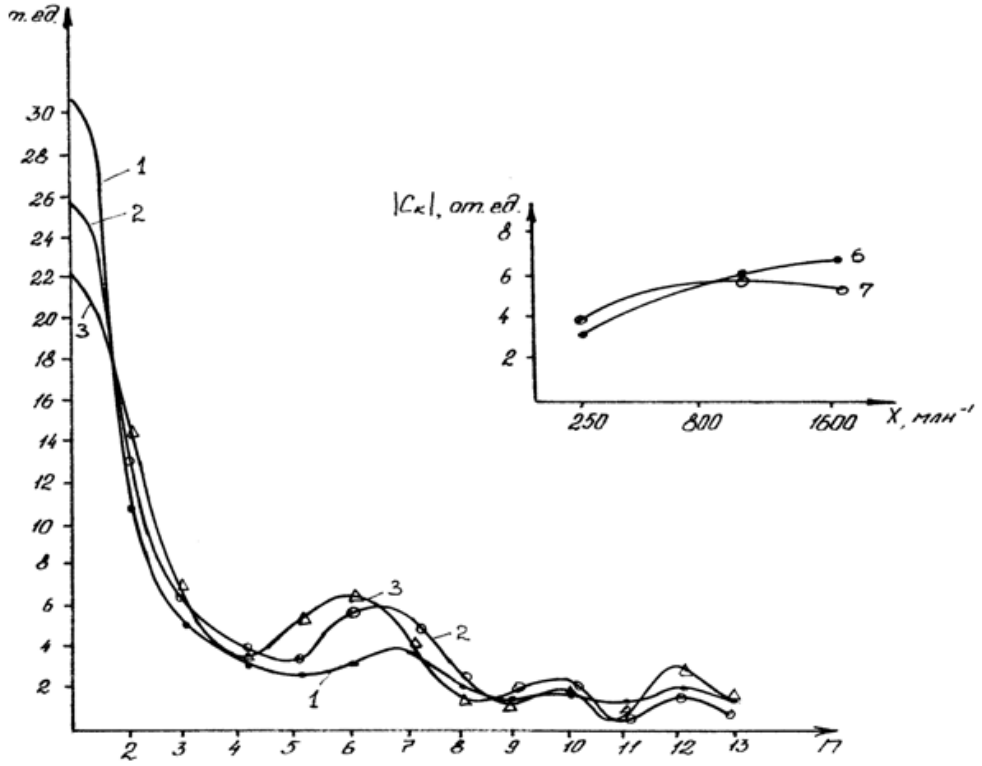

Рис. 4: Перерозподіл амплітуд гармонік корисного сигналу при збільшенні концентрації χNH_3

Зсув ділянки спектру, що сканується. Дослідження проводилися при використанні концентрації NH_3 або NO_2 в кюветі рівній 1000 млн$^{-1}$. Знімався спектр поглинання NH_3 в області (190-230) нм та NO_2 в області (430-460) нм. З отриманих спектрів вибиралися зміщені один відносного одного більш вузькі ділянки спектра і проводилося обчислення їхніх Фур'є образів.

На рис.5 наведено перерозподіл амплітуд гармонік в разі зміщення спектру NH_3 (а), структура якого квазіперіодична, і NO_2 (б), що має значну аперіодічність структури. Як бачимо, зсув сканованої ділянки спектру призводить до значного перерозподілу амплітуд гармонік.

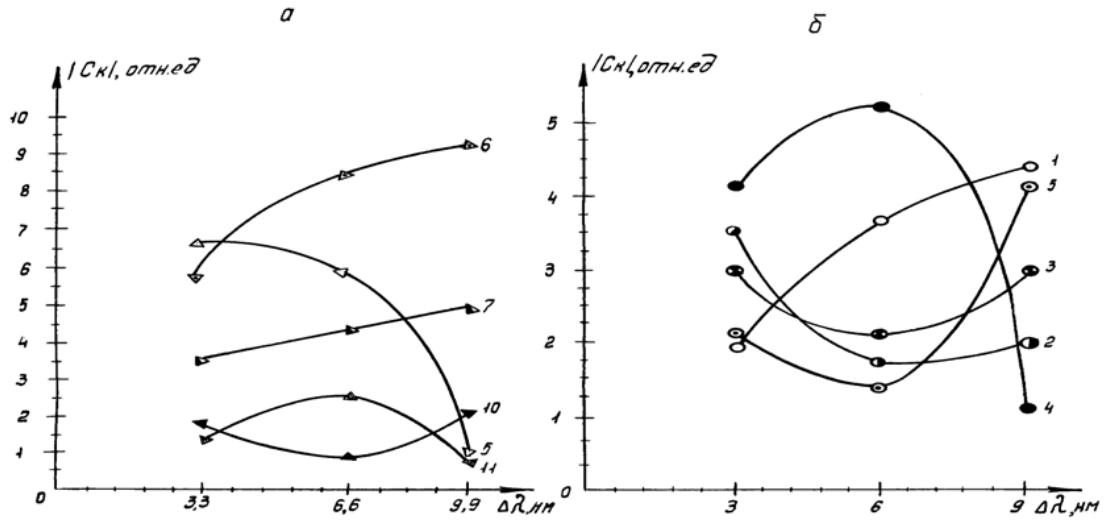

Рис. 5: Перерозподіл амплітуд гармонік корисного сигналу у випадку зміщення спектрів NH_3 (а) та NO_2 (б) у вихідній площині спектрометра

Причому у другому випадку амплітуди гармонік зазнають суттєвих змін вже починаючи з першої гармоніки, в першому - значно змінюються амплітуди тільки більш високих гармонік. З рис. 5 випливає, що при ретельному виборі ділянки спектру можна значно збільшити амплітуду гармоніки, пов'язану з наявністю досліджуваного газу в кюветі, а значить, і підвищити відношення сигнал/шум при вимірах корисного сигналу. Тому, вибору ділянки спектра і стабільності його положення в площині вихідної щілини монохроматора слід приділяти значну увагу.

Вибір ширини ділянки спектра, що сканується. При середньоквадратичному детектуванні корисного сигналу, що зазвичай прийнято в газоаналітичних приладах, його величина визначається площею, що знаходиться під обвідною корисного сигналу. Причому ця площа залежить, при нецілому числі сканованих періодів $Д$ структури спектру смуги поглинання, від початкової фази (початкової довжини хвилі) сканування.

Дійсно, нехай, наприклад, сканується $m = 4{,}5$ періодів $Д$ структури спектру NH_3. При незначних концентраціях NH_3 в кюветі сканований спектр може бути представлений у вигляді позитивних напівперіодів синусоїди. Тоді сигнал, що знімається з ФЕП, може бути записаний у вигляді:

$$I_o \sin\pi t/\tau, \text{ при } 2n\tau<t<(2n+1)\tau \quad I(t) = \{ \\ -I_o \sin\pi t/\tau, \text{ при } (2n+1)\tau<t<2(n+1)\tau \tag{3}$$

де $n = 0,1,2 \ldots k$; $\tau = Д/\Delta\lambda f_0$ - період сигналу, що відповідає періоду структури, досліджуваного газу; f_o - частота сканування спектральної ділянки $\Delta\lambda = m Д$.

Зазвичай досліджувана ділянка спектру виділяється діафрагмою, спектральна ширина якої дорівнює $\Delta\lambda$ і розміщеної у площині вихідної щілини (в безпосередній її близькості). Тоді, у разі вимірювання положення спектру щодо діафрагми, можливий випадок, коли сканується 4 цілих періоди структури спектра і 0,5 періода, і коли сканується 4 цілих періоди і два по 0,25 періоди (див. рис.6). У першому випадку величина сигналу після детектування буде дорівнювати:

$$I_1 = 4I_0 \int_0^{\tau} \sin\pi t/\tau dt + I_0 \int_0^{\tau/2} \sin\pi t/\tau dt = 9\, I_0\, \tau/\pi \tag{4}$$

у другому:

$$I_2 = 4I_0 \int_0^{\tau} \sin\pi t/\tau dt + 2I_0 \int_0^{\tau/4} \sin\pi t/\tau dt = 8{,}6\, I_0\, \tau/\pi \tag{5}$$

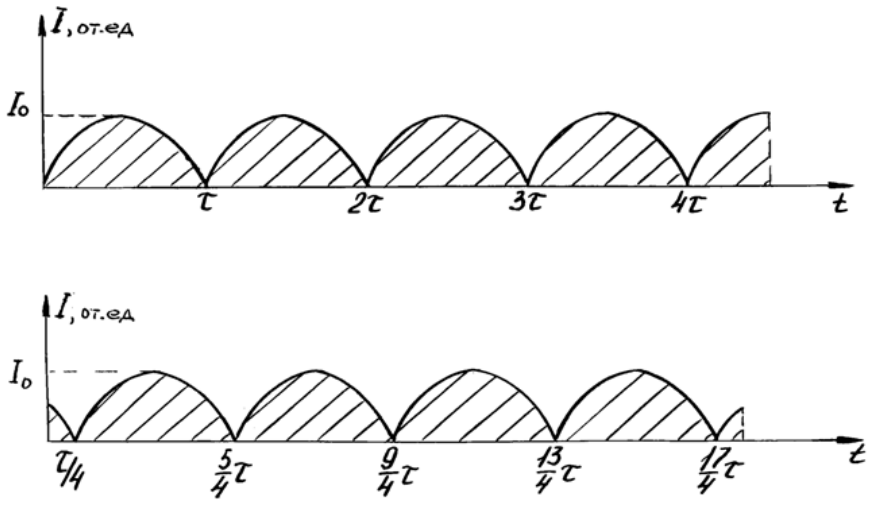

Рис. 6: Величина корисного сигналу при скануванні (4+0.5) періодів структури спектру аналізованого газу (а) та (4+2·0.25) (б)

Таким чином, відносна зміна сигналу при зсуві спектру досліджуваного газу щодо діафрагми дорівнюватиме:

$$\Delta = (I_1 - I_2)/I_{cp}100\% = 4{,}5\%, \quad (6)$$

де $Icp = (I_{1+} I_2)/2$.

Такі коливання корисного сигналу призводять до значних похибок вимірювання. Так, якщо максимальна концентрація досліджуваного газу дає ослаблення сигналу на 30% (таке значення зазвичай вибирають для досягнення лінійності шкали газоаналізатора), то інструментальна похибка приладу при зазначених коливаннях корисного сигналу не може бути краще 15%.

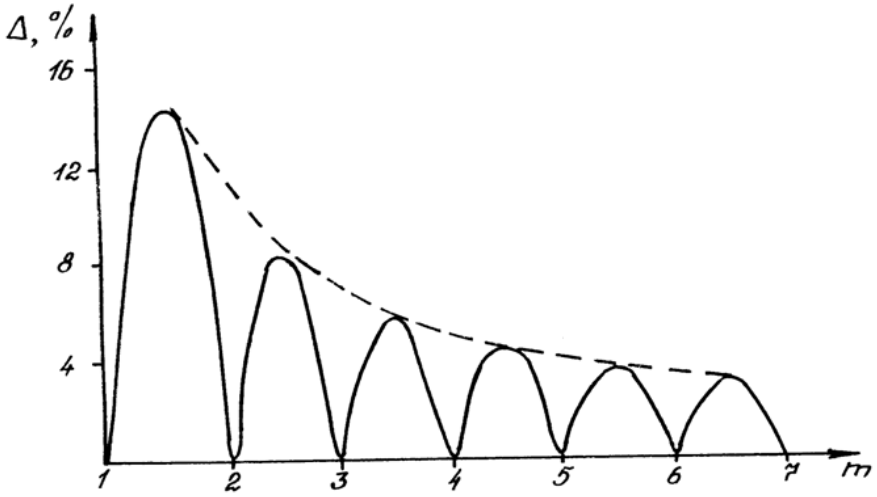

Рис. 7: Зміна величини корисного сигналу при зміщенні спектру аналізованого газу у вихідній площині спектрометру в залежності від кількості періодів спектру, що сканується

Легко бачити, що якщо m дорівнює цілому числу періодів структури спектру, наприклад $m = 4$, то при будь-якому положенні спектру щодо діафрагми величина детектованого сигналу буде одна й та ж:

$$I_1 = I_2 = 4I_0\int_0^{\tau} \sin\pi t/\tau dt = 8\, I_0\, \tau/\pi \quad (7)$$

Тобто зміщення спектру досліджуваного газу щодо діафрагми, встановленої за вихідною щілиною і ділянкою спектру, рівне цілому числу періодів структури цього спектра, не призводить до появи додаткової похибки вимірювань.

Звичайно, зі збільшенням числа m відносний внесок нецілих частин $Д$ зменшується. На рис. 7 показана теоретична залежність відносної зміни корисного сигналу при зсуві спектру досліджуваного газу в площині вихідної щілини в залежності від m. Як бачимо, зменшення Δ при збільшенні m спочатку відбувається досить швидко, а далі ця зміна насичується.

Виділення корисного сигналу в електронному тракті приладу

Отже, при вимірі концентрації аналізованого газу, що має хорошу періодичність структури спектру, за допомогою приладу на основі скануючого монохроматора необхідно відфільтрувати кілька гармонік корисного сигналу, близьких до n-ої, від інших гармонійних складових електричного сигналу, що знімається з фотоприймача. Для цієї мети може служити узгоджений з сигналом фільтр. Справді, кожну ділянку зображеного на рис. 1 електричного сигналу, можна розглядати як незалежний, окремий відрізок синусоїди з частотою ω_o обмеженою тривалістю і з випадковою фазою. Спектр цього сигналу можна знайти за допомогою перетворення Фур'є. Якщо відрізок синусоїди представити у вигляді:

$$\Omega(t) = \begin{cases} 0, & \text{при } t<0 \\ \sin \omega_o t, & \text{при } 0<t<2\pi n/\omega_o \\ 0, & \text{при } t>2\pi n/\omega_o \end{cases} \quad (8)$$

то його спектр буде мати вигляд:

то його спектр буде мати вигляд:

$$\Phi(\omega) = \int_0^{2n\pi/\omega o} \sin \omega_o t \exp(i\omega t) dt = 2i\omega_o/(\omega_o^2 - \omega^2)(-1)^n \sin n\pi\omega/\omega_0 \quad (9)$$

Отриманий спектр зображений на рис 8. Він являє собою центральний максимум, в якому зосереджена основна частина енергії і ряд незначних бічних максимумів.

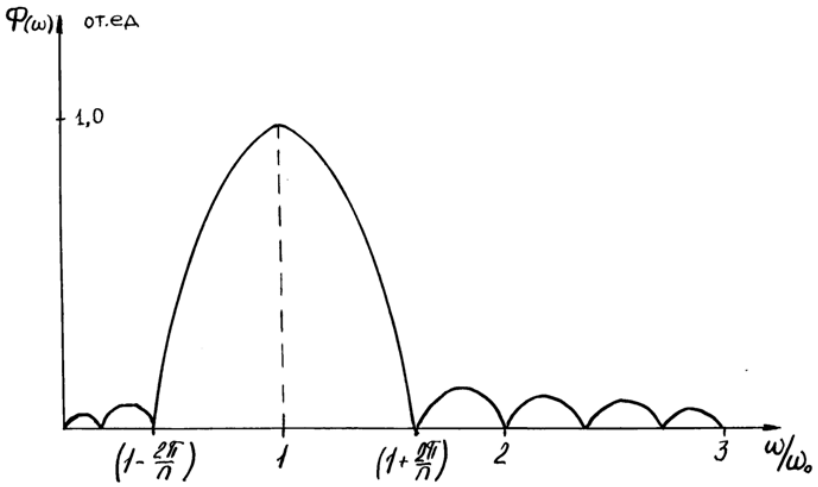

Рис. 8: Спектр електричного сигналу, що знімається з фотоприймача при скануванні n періодів синусоїдальної структури спектру аналізованого газу

Ширина основного максимуму звужується в міру збільшення кількості періодів синусоїди у цузі і може бути визначена з виразу (9) або, використовуючи відоме співвідношення:

$$\Delta v \cdot \Delta t = 1 \quad (10)$$

У даному випадку вона дорівнює: $\Delta\omega/\omega_0 = 1/n$.

Тобто, нам необхідно відфільтрувати отриманий спектр від спектру фонового сигналу, пов'язаного, наприклад, з наявністю компонентів, що заважають. У відповідності з теорією оптимальної фільтрації, в разі перешкод з рівномірним спектром передатна функція такого фільтру з точністю до постійного множника повинна бути комплексно спряженою функцією щодо спектра $\Phi(\omega)$ аналізованого сигналу:

$$k(i\omega) = k\,\Phi(i\omega). \quad (11)$$

Тобто передатна функція повинна з точністю до постійного множника збігатися зі спектром сигнала, що виділяється. В цьому випадку їх кореляційна функція (відгук фільтру) дорівнює максимально можливій величині:

$$R(\omega)max = \int_{-\infty}^{\infty} \Phi(\omega')\Phi^*(\omega' - \omega)d\omega \quad (12)$$

Таким чином виділення корисного сигналу в електронному тракті кореляційного аналізатора відбувається за рахунок кореляції спектру цього сигналу з еталонним, записаним в пам'ять приладу.

Експериментально вивчався спектр корисного сигналу при скануванні з частотою $\omega_p = 1$ кГц ділянки смуги поглинання SO_2 від 210 до 230 нм. Суміш SO_2 в N_2 концентрацією 200 млн$^{-1}$ напускалася у внутрішню кювету оптичного блоку приладу ФГ 01-1. З ФЕП-142 оптичного блоку знімався часовий сигнал, зображений на рис. 1. Цей сигнал подавався далі на селективний вольтметр В6-9 і з його допомогою вивчався спектральний склад корисного сигналу. Експериментально отриманий спектр сигналу зображений на рис. 9. Максимум на 10-ій гармоніці обумовлений наявністю SO_2.

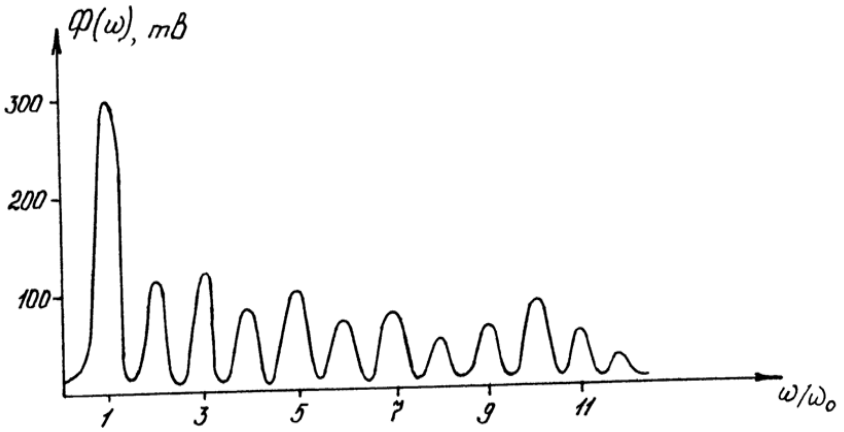

Рис. 9: Спектр електричного сигналу, що знімається з ФЕП 142 оптичного блоку приладу ФГ01-1 при концентрації SO_2 $\boldsymbol{x}$=200млн$^{-1}$

Як бачимо, непарні гармоніки мають більшу амплітуду ніж парні. Це пов'язано, можливо, з биттям диску сканованої вихідної щілини. Ширина гармонійних складових дорівнює ≈200 Гц.

II. Структурна Схема Аналізатора Диоксиду Сірки

Структурна схема кореляційного аналізатора вибиралася, виходячи з таких передумов[1]:

а) аналізатор SO_2 повинен бути переносним приладом для інспекційного контролю викидів ТЕС;
б) вимірювання повинні проводитися в газоході для виключення можливості втрат інформації в системі пробо підготовки;
в) внаслідок сильної запиленості газів, що відходять, необхідний захист оптичних елементів від впливу пилу, сажі, золи, вологи.

Враховуючи ці вимоги, структурна схема приладу отримала вид, зображений на рис. 10. Потік випромінювання від дейтерієвої лампи 1 типу ДДС-30 формується за допомогою конденсора 2 і направляється в газохід. Оскільки коефіцієнт поглинання SO_2 в УФ області досить великий, то довжина кювети для аналізу необхідних концентрацій SO_2 повинна бути 45мм для діапазону 0-5,46 г / м^3 і 15мм для діапазону виміру 0-16 г / м^3. У той же час вимірювання SO_2 в газоході повинні проводитися на відстані не менше 300мм від внутрішньої стіни газоходу для виключення можливості перепадів концентрації по перерізу газоходу. У зв'язку з цим відкрита кювета, через яку проходить досліджувана речовина, утворена плоскопаралельною кварцевою пластиною 3 і призмою 4, встановленою на кінці зонда, який жорстко кріпиться до приладу і вводиться в газохід. Довжина зонду досягає 1м.

Газова проба надходить в кювету внаслідок наявності газового потоку в газоході і шляхом природної дифузії через металокерамічний кожух, у який вона встановлюється. Відбившись від призми, потік випромінювання повторно проходить через кювету і повертається в аналізатор. За допомогою об'єктива 5 випромінювання фокусується на вхідну щілину 6 монохроматора і заповнює увігнуту дифракційну решітку 7, радіусом 250 мм і з кількістю штрихів на 1 мм рівною 2400. Дифракційна решітка розкладає по спектру падаюче випромінювання і фокусує його на вихідну рухливу щілину 8. Вихідні щілини 8 нарізані на диск діаметром 76 мм за його радіусом. Загальна кількість нарізаних щілин дорівнює 20. Диск встановлений на осі синхронного двигуна 9 типу ДС-12. Якщо у газоході присутній SO_2, то у фокальній площині решітки спостерігається його спектр поглинання. Діафрагма 10 обмежує величину сканованої ділянки спектру, рівної (210-230) нм (див.рис. 1). На цій ділянці спектра присутні 10 максимумів поглинання SO_2.

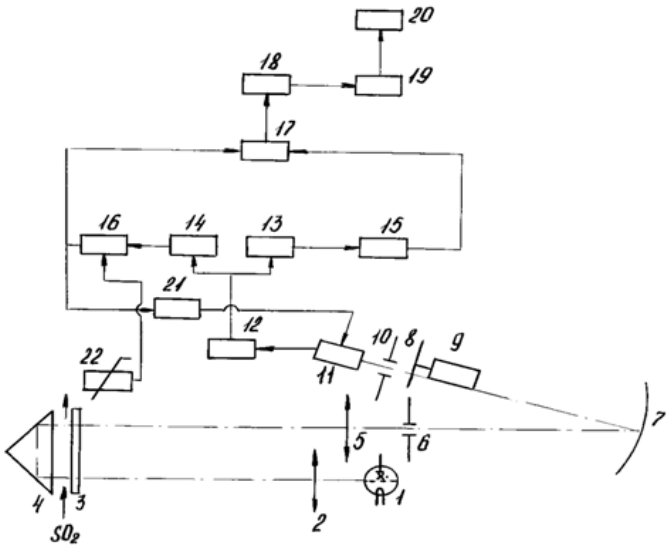

Рис.10: Структурна схема приладу для аналізу SO_2

Щілини 8 на диску нарізані таким чином, щоб *n*-та щілина, закінчивши сканування спектру SO_2, вийшла за межі діафрагми 10, а *(n+1)*-ша увійшла. Таким чином, при обертанні диска відбувається безперервне сканування спектру SO_2 в спектральному діапазоні (210-230) нм. Як приймач випромінювання 11 використовується сонячно-сліпий ФЕП 142. Сигнал з фотоприймача 11 надходить на попередній підсилювач 12. Оскільки тільки частина випромінювання поглинається SO_2 в зазначеному діапазоні довжин хвиль, то з ФЕП знімається як змінна $V_{\sim}$, так і постійна $V_{=}$ складова сигналу.

Форма сигналу, що знімається з ФЕП після посилення в попередньому підсилювачі 12 зображена на рис. 1. Величина постійної складової $V_{=}$ залежить від концентрації в газоході SO_2 і інших поглинаючих випромінювання в цій області спектру компонентів, від параметрів джерела випромінювання та ФЕП. Тобто в ній міститься корисна інформація, яка може бути використана при обробці сигналів. Тому $V_{=}$, $V_{\sim}$ посилюються відповідними підсилювачами 13,14, детектуються детекторами 15, 16 і подаються на вхід АЦП 17. У АЦП величина $V_{=}$ використовується в якості опорної напруги, а $V_{\sim}$ надходить на інформаційний вхід. Таким чином в АЦП відбувається перетворення аналогових сигналів в цифрову форму і одночасно береться відношення $V_{\sim} / V_{=}$. Сигнал з АЦП поступає в постійно запам'ятовуючий пристрій (ПЗП) 18, де записана залежність концентрації аналізованого газу (SO_2) від відношення сигналів робочого і опорного каналів і далі в блок виводу інформації 19. Блок виведення інформації розподіляє інформацію у відповідній формі між блоком індикації 20, виходом на цифро-друкуючий пристрій (ЦДП), виходом на самописець. У блоці індикації 20 здійснюється динамічна індикація результатів вимірювання на трьохрозрядному світлодіодному індикаторі. Для врахування залежності показів аналізатора від його температури встановлений датчик температури 22 (термоопір), з'єднаний зі схемою компенсації нуля детектора. У залежності від температури аналізатора, змінюється величина корисного сигналу, що поступає на інформаційний вхід АЦП 17.

Оскільки на опорний канал АЦП має подаватися певне значення постійної напруги (10 В), величина постійної складової $V_{=}$, що надходить на АЦП, підтримується на цьому рівні за рахунок регулювання підсилення ФЕП за допомогою ланцюга зворотного зв'язку, що включає блок живлення ФЕП 21. Таким чином, при зміні величини постійної складової сигналу $V_{=}$, викликаному поглинанням SO_2 в газоході, запиленістю оптичних елементів, зростає напруга на ФЕП, не перевищуючи допустимого значення (2,2 кВ). Інші блоки живлення (лампи ДДС-30, електроніки) на рис. 10 не показані.

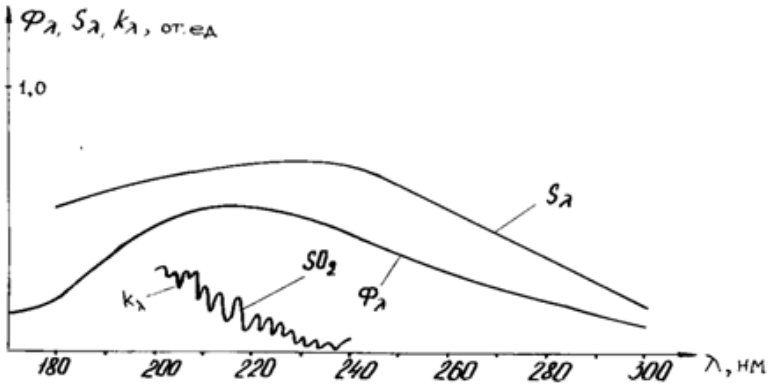

Рис. 11: Спектральні залежності чутливості фотокатода S_λ ФЕП 142 світлового потоку Φ_λ лампи ДДС-30 і коефіцієнта поглинання K_λ SO_2

Щодо вибору області аналізу SO_2 - (210-230) нм, то вона обумовлена спектральними характеристиками обраної елементної бази (ФЕП-142, лампи ДДС-30), а також відносно невеликим інтегральним поглинанням SO_2 в цій області.

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Оптимизация параметров сканирующего спектрометра для анализа газов

В работе приведены результаты оптимизационого расчета параметров дисперсионных приборов газового анализа в УФ и видимой областях спектра, котрые используют корреляционное выделение полезного сигнала в его электронном тракте. Предложены медоты оптимального выбора этих параметров. Как пример использования этих типов приборов описана структурная схема газоанализатора SO_2 в отходящих газах тепловых электростанций.

Optimisation of parametres of a scanning spectrometer for the gas analysis

In the article results of optimization calculation of parametres of scanning spectrometer for the gas analysis in UV and visible fields of a spectrum are considered. The correlation selection of the useful signal in its electronic path is used. The methods of optimum choice of these parametres are offered. The block-diagram of gas analyzer SO_2 in exit gases of thermal power stations is described as an example of use of these types of devices.

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Global Journal of Science Frontier Research: B Chemistry
Volume 23 Issue 2 Version 1.0 Year 2023
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

The Impact of Rosemary on Cardiovascular and Hypertension Diseases: A Mini-Review

By Abdessamad Benabbou, Abdelhamid Bitari, Adyl Oussaid, Abdelouhed Oussaid, Rachid Touzani, Belkheir Hammouti & Savas Kaya

University Mohammed Premier

Abstract- An estimated 17.7 million deaths are attributable to cardiovascular disease, or 31% of total global mortality, cardiovascular diseases (Hypertension) represent one of the most significant health problems of modern civilization. Stroke; and heart attack often lead to lethal outcomes; the essential problem underneath is thrombus formation. Prophylactic approaches include acetylsalicylic acid and clopidogrel therapy on the level of primary hemostasis, i.e., primary clot formation.Thus, the application of plant species, medicinal plants rich in rosmarinic acid and polyphenols, and flavonoids in the prevention of thrombus formation is of interest. The rationale of the present review is to analyse the activity of Rosmarinus officinalis in the cardiovascular system. Pre-clinical; studies under experimental conditions show that Rosemary has a marked effect on Hypertension.

Keywords: rosemary; rosmarinus officinalisl.; hypertension; cardiovascular diseases; rosmarinic acid; flavonoids.

GJSFR-B Classification: DDC Code: 616.132 LCC Code: RC685.H8

Strictly as per the compliance and regulations of:

The Impact of Rosemary on Cardiovascular and Hypertension Diseases: A Mini-Review

Abdessamad Benabbou [α], Abdelhamid Bitari [σ], Adyl Oussaid [ρ], Abdelouhed Oussaid [ω], Rachid Touzani [¥], Belkheir Hammouti [§] & Savaş Kaya [χ]

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I. Introduction

Low levels of blood pressure are not considered a significant disease as they do not imply a risk to a patient's life. Nonetheless, people suffering from Hypotension, mainly chronic or constitutive hypotension, suffer from physical and psychological symptoms such as temporary fatigue and sensation of weakness that usually affect their daily life and health-related quality of life [1, 2]. Several herbal remedies have been traditionally used to treat hypotension, such as those plants rich in purine bases (i.e., caffeine, theobromine [3]), likecoffee tea (Camellia Sinensis [4]) or cola (Cola nitida or Cola acuminata [5]), or different essential oil-containing plants. Rosemary (*Rosmarinus officinalis L.*) is a spontaneous shrub growing in the Mediterranean. It; belongs to the Lamiaceae family and has been used because of its medicinal properties in the earliest times The first references cited the traditional use of rosemary oil as a tonic for asthenia relief, blood circulation, and the nervous system, chronic weakness, as then and, peripheral vascular disorders. For medicinal purposes, Rosemary oil was distilled during the Middle Ages and used as a tonic, stimulant, and carminative for dyspepsia, headache, and nervous tension, as described in the Dioscorides Materia Medica in 1555 [6,7]; as a bath additive, it has been traditionally used in conditions of exhaustion and for stimulation of circulation [8]. And, Indian Materia Medica [9], described it as having carminative and stimulant actions. The; British Herbal Pharmacopoeia (1983) lists the specific indications of "Depressive states with general debility and indications of cardio-vascular weakness" for Rosemary oil. Nowadays; rosemary essential oil has used as a brain and nerve tonic, and as a remedy for mental fatigue [10]. Several; other activities are reported in the literature: antiseptic, diuretic, antidepressant, and antispasmodic; it is also used to treat colds, influenza, and rheumatic pain [11,12] and has proved to enhance the performance for overall quality of memory and secondary memory factors [13]. Rosemary leaves contain no less than 12 ml/kg of essential oil, whose composition may vary according to the plant chemotype or other factors such as climatic conditions, geographic origin, or time of collection [14-17]. This work aims is to study *Rosmarinus officinalis* essential oil's effect on primary hypotension and so, its positive impact on the HRQOL of patients. To determine the relationship between the two types of variables in the study and to assess the effectiveness of Rosemary essential oil, statistical methods were used as a key tool. Quantitative variables (SBP and DBP), and scores from physical and mental summary measures were obtained from the SF-36 Health Survey.

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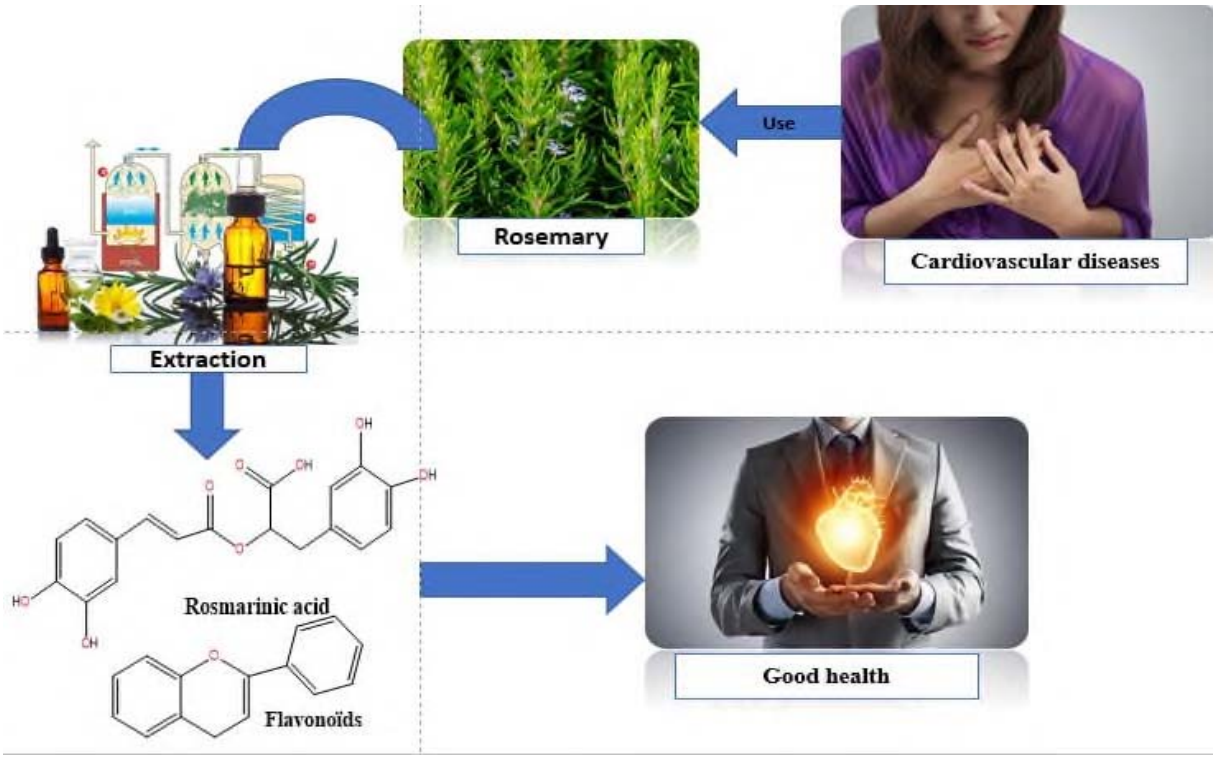

Figure 1: The Effect of Rosemary on Cardiovascular Diseases.

II. Cardiovascular Diseases

Cardiovascular diseases (CVD) [18] are disorders of the heart and blood vessels and include conditions such as Hypertension, hyperlipidemia, thromboembolism, coronary heart disease, and heart failure. The most prevalent of these is hypertension, which is a major factor in the development of CVDs [19]. According to tong, World Health Organization (WHO), over 17 million people die per year (31% of all global deaths) from CVDs). Before 2030, it is predicted that mortality will reach 23.3 million due to the rise in CVD diagnoses [20].

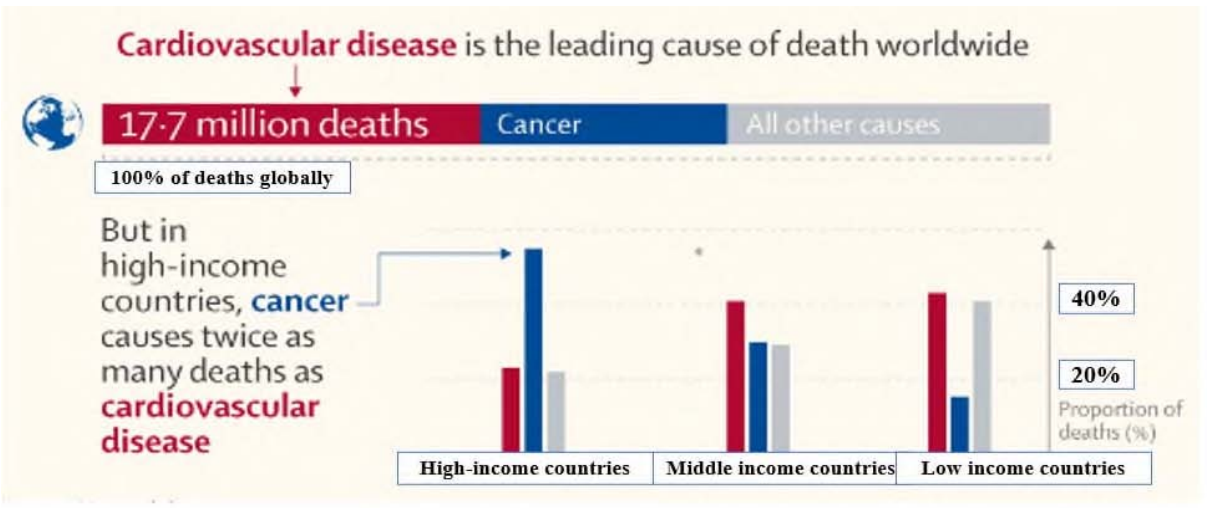

Figure 2: Cardiovascular Diseases Risk Factors and Mortality Around The World (WHO).

For instance, the most common cause of death in Morocco is cardiovascular disease. These illnesses can be divided into various categories., namely, valvulopathy, heart failure, arterial Hypertension, ischemic heart disease, cardiomyopathy, and arterial diseases. This project's goal is to describe the prevalence of cardiovascular diseases according to the age and sex of patients and to study the association between sex, age, and the appearance of different types of cardiovascular diseases [21].

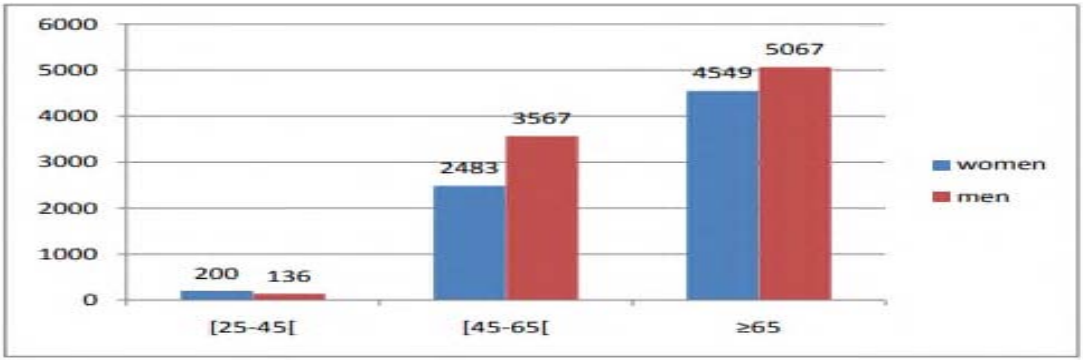

Figure 3: Distribution of Patients by Age and Sex [21]

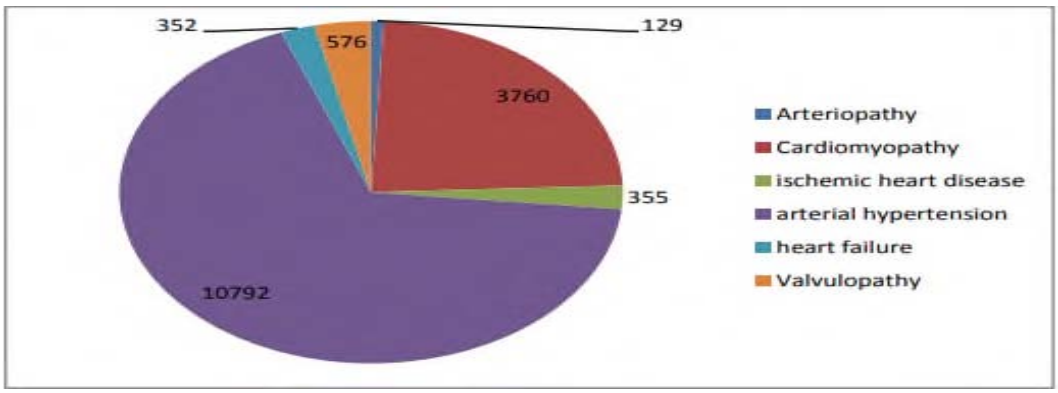

Figure 4: Prevalence of Cardiovascular Diseases during the Study Period [21]

The survey involved 16002 patients, including 7232 women (45.2%) and 8770 men (54.8%) with a slight male predominance (sex ratio = 1.21, chi-square test = 87.3, ₱ 0.0001). It was 70.27 16.5 years on average. Women are most affected in young adults, while men outnumber women in adults and seniors (Figure 3). Cardiovascular disease prevalence was as follows: Hypertension (67.4%), cardiomyopathies (23.2%), valvulopathies (3.6%), ischemic heart disease (2.2%), cardiac insufficiency (2%), and arterial diseases (1%) (Figure4) [21].

Cardiovascular diseases include pathologies that affect the heart and all blood vessels, such as (WHO):

- Stroke
- Atherosclerosis
- Congenital heart disease
- Myocardial infarction
- Heart failure
- Diseases of the vessels
- Heart rhythm disorders
- High blood pressure (Hypertension)

III. Hypertension

Blood pressure is the force exerted by circulating blood on the walls of the arteries, that is to say, the main vessels that allow blood circulation in the body. We speak of hypertension when this pressure is too high (WHO).

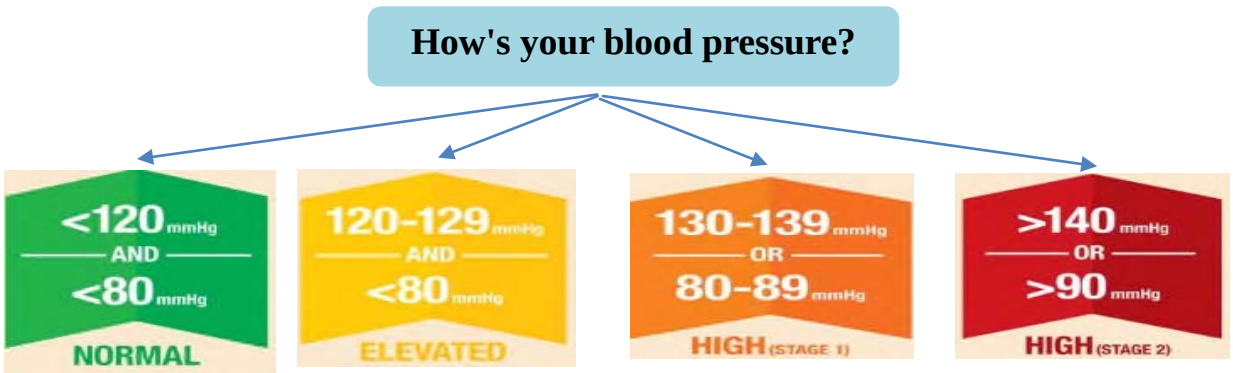

Figure 5: Chart of Blood Pressure (WHO)

As per a statement of the World Health Organization (WHO), Hypertension is one of the silent killers in the 21st century and is one of the biggest global public health concerns. Hypertension is amajor contributor to cardiac complications, stroke, heart disease, kidney failure, blindness, premature death, and disabilities. Hypertension is curable and treatable, for which there is a need for involvement from individual entities, government and private sectors, health workers, and civil societies moreover, personal awareness is highly recommended.

As per the estimation of WHO, globally more than 1.13 billion people are affected with Hypertension among which less than 1 in each 5 is under control. Unhealthy diets, lack of physical activities, and consumption of alcohol & tobacco are the main contributing factors to Hypertension. In 2016, the Global Heart Initiative was launched by the World Health Organization and the US Centers for Disease Control and Prevention. Globally, Hypertension or High Blood Pressure leads7.5 million death cases which, share about 12.8% of all death cases recorded. Hypertension also accounts for about 57 million disabilities adjusted life years which is about 3.7% of total adjusted life years. In 2016, the Global Heart Initiative was launched by the World Health Organization and the US Centers for Disease Control and Prevention.

The Global prevalence of Hypertension in adults aged>25 was about 40% in 2008. From 1980 to 2008, there was a moderate prevalence. But, due to sharp growth in population, the aging population uncontrolled Hypertension reached 1 billion in 2008 from 600 million. The prevalence of Hypertension was highest in Africa (>40%) and lower in the Americas (35%) [22]

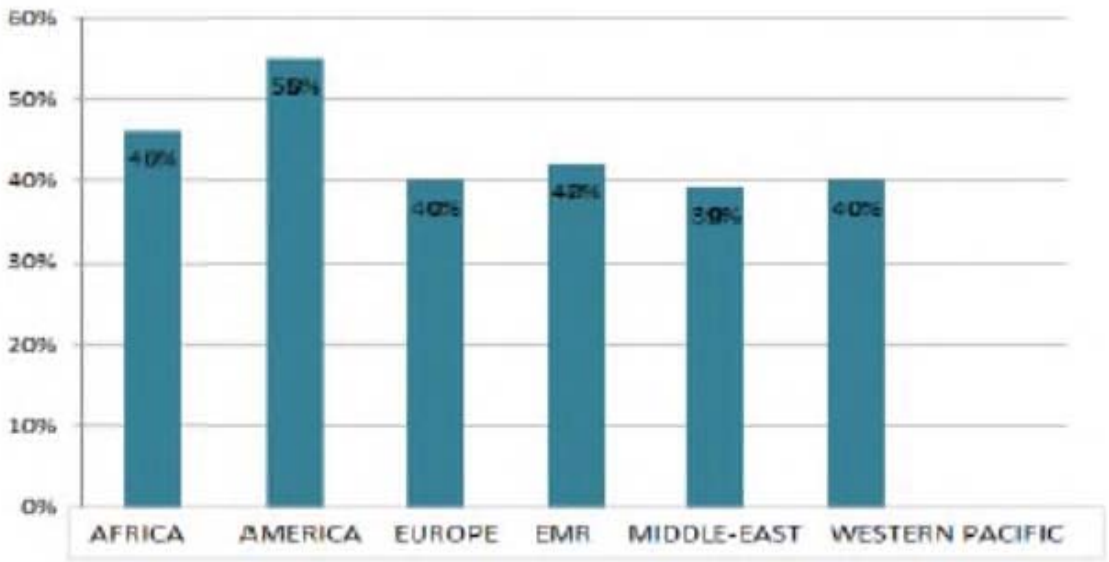

Figure 6: Hypertension Statistics World 2020 [22]

What is the risk factor?

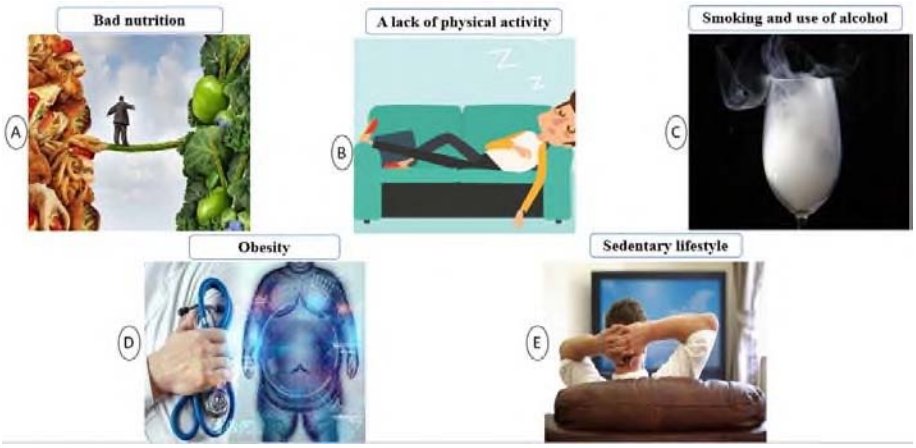

Figure 7: Factors of the Risk of Cardiovascular Disease and Hypertension (A&B [24], D [23] E [24], C [25])

IV. Rosemary

Rosemary is a medicinal plant of the Lamiaceae family which is called in Arabic Azir and French Romarin, the scientific name of this plant is *Rosmarinus officinalis*. Rosemary, a plant Abundant in the wild all around the Mediterranean, is traditionally valued for its bioactive constituents, with antioxidant, anti-inflammatory, and anti-cancer, antifungal, antibacterial, insecticide, and hepaprotective properties, which can be removed by distillation under form aromatic oils or by extraction in solvents in the form of extract or oleoresin. Rosemary leaves contain macronutrients (Ca, K, P, Na) and micronutrients (trace elements) (Cu, Zn, Mn, Fe) [26]. They are a good source of vitamins A, B, and C [27].

Rosemary is similarly used in cosmetic formulations and in treating pathological and non-pathological conditions, such as cellulite, alopecia, ultraviolet damage, and aging [28].

a) Other Names

- azir, barkella, haselban, Aklilljabal, klile (in North Africa) [29].
- Grass-aux-courounnes, sea dew, sea rose, rosemary of the troubadours, bouquet-de-la-vierge (France).
- Folia Anthos, Folia Rorismarini, Encensier, rosemary (Angle), Rosmarinblatter, Krankrautblatter, Kranzen-krautblatter, Rosmarein (Allemand).

Rosemary has long been known for its medicinal properties, especially by the Greeks and Romans. Later produced crowns, thus the Arabic name Iklilal-Jabal (mountain crowns), translated from Latin. In the Middle Ages, it enjoyed great prestige as a medicine for paralysis. The water of the Queen of Hungary, famous in the seventeenth century because Queen Isabella, tasty and paralytic, used it as water of youth, was nothing but rosemary alcoholate. It is also a grilling condiment. Rosemary supplies an important distillation industry in Maghreb [29]. Since Morocco has excellent potential in the field of aromatic and medicinal plants.

b) Botany

Branched, woody, 1 m tall, bushy, and aromatic shrub. The leaves are narrowly lanceolate and up to 3 cm long and 4 mm wide, causes, and friable; The edge is involuted downwards (top row). On their upper side, young leaves are pubescent, while the older ones are glabrous. They are wrinkled and streaked due to a sunken midrib, which is very prominent on the underside, and covered by a dense white pubescence. The January blooming of the flowers, pale blue or lilac, are grouped in axillary and terminal racemes in the upper part of the branches [29]. These spiciform inflorescences bear subsessile flowers in all seasons. The gamosepalous calyx, bilabiate bell-shaped, has three lobes. The gamopetalous corolla is long and tubular with a helmet-shaped upper lip with two lobes and a lower lip with three lobes. The two protruding stamens protrude well beyond the corolla; two others are reduced to square brackets. The fruit is brown achene [30]. This very polymorphic species has several varieties. But Many botanists prefer to use the chemical makeup of the essential oil to classify four chemotypes instead of this sporadic morphological differentiation., according to the dominant compound:

1. Rosemary in cineole,
2. Rosemary with verbenone,
3. Rosemary with camphor,

c) Chemical Composition

Essential Oils: 1 to 2.5% Rosemary flowering tops provide 10 to 25ml / kg of an essential oil whose main constituents are: camphor (15 to 25%), cineole (15 to 50%), alpha-pinene (10 to 25%) and borneol, free and esterified. Among other things, the essential oil's composition varies. Depending on the origin, the French pharmacopeia retains two types of products: the Morocco and Tunisia type and the Spain type. resulting from hydro-distilling natural populations, these essential oils differ slightly in their composition and physical constants [30].

Table 1: Chemical Composition of Rosemary EO [31]

Compound	Mroroccooil	Spain oil	Algerieoil
α-Pinene	12.51	24.7	5.2
1, 8-Cineole	47.44	18.9	52.4
Camphene	3.62	11.2	3.0
β-Myrcene	1.57	4.9	1.7
Borneol	2.97	4.5	3.4
Verbenene	-	-	-
Bornylacetate	0.23	1.0	1.1
Camphor	7.9	18.9	12.6
Verbenone	0.46	-	-
Verbenol	-	-	-
β-Pinene	7.2	3.4	5.7

Linalool	0.7	1.0	1.1
β-Caryophyllene	3.31	2.2	4.2
3-Octanone	-	-	-
β -Phellanderene	-	-	-
Limonene	1.9	3.1	-
Sabinene	0.12	0.4	-

Other Chemical Compositions of Rosemary

- *Flavonoids:* luteolin, apigenin, quercetin, diosmin.
- *Diterpenes:*carnosic acid, rosmadial.
- Triterpenes and steroids: oleanolic acid, ursolic acid.
- Tannins.
- *Lipids:* n-alkanes, isolalkanes, alkenes.
- Rosmarin.
- Rosmarinic acid.

There are two ways to extract bioactive molecules from Rosemary.:

- *By conventional so-called conventional methods:* Hydrodistillation; Steam distillation; Aqueous Alcoholic Extraction by Fermentation; Maceration; Two-step extraction with organic solvents (hexane, ethanol); Extraction by pressurized liquid.
- *By new and innovative methods:* CO_2 extraction; Supercritical CO_2 extraction; Subcritical state extraction (H_2O); Extraction assisted by ultrasound; Microwave assisted extraction; Extraction by microwaves without solvents; extraction by hydrodiffusion by microwaves and gravity; Extraction by microwave vapor diffusion; Extraction by instantaneous controlled pressure drop; by Advanced Technology Phytonics (non-chlorinated fluorohydrocarbons); Extraction by High Voltage Pulse Fragmentation Technology…[32].

V. The Effect of Rosemary on Cardiovascular Diseases and Hypertension

Epidemiological and clinical studies on the influence of flavonoids on cardiovascular diseases are rare and inconsistent. The main issue outlines the evolutionary exposition of flavonoids through diet and developed mechanisms that reduce their bioavailability (transporters that reduce absorption and metabolism that increases excretion from the body). Although studies on the European population show consumption of flavonoids of more than 100 mg per day [33], the bioavailability of flavonoids is limited to up to 24 % as reported for quercetin. As the half-life of quercetin in plasma is 11 to 28 hours, it is regarded that slow elimination increases the accumulation of quercetin in the body [34]. Usually, concentrations up to 1 mol L-1 are reported for plasma [35]. According to research conducted by our team, flavonoids can have clinically significant interaction with the ristocetin and arachidonic acid-induced platelet aggregation assay. even at very low flavonoid concentrations (i.e., 60 nmol L–1) can influence platelet aggregation assays induced by arachidonic acid and ristocetin. These assays are used for the assessment of von Willebrand factor (vWF) function [36], and flavonoids can consequently cause misdiagnosis of blood clot disorders related to vWF. In a clinical study on healthy males, the influence of tomato (*Solanum lycopersicum L.*)[37] pomace extract was tested ex vivo [38]. It showed a reduction of platelet aggregation in the test induced by ADP (5 days after starting the treatment, three hours after ther last dose was consumed). While the polyphenol profile of tomato extract was analyzed by high-performance liquid chromatography coupled with mass spectrometry (HPLC-MS), no clear indication of component(s) responsible for the activity was provided. Polyphenols-enriched beverage (326 mg L^{-1} of gallic acid equivalent) reduced platelet aggregation in healthy athletes after stress (marathon)[35]. Anthocyanin consumption (320 mg per day) by healthy volunteers reduced ex vivo platelet aggregation by 29 % in platelet aggregation assay induced by ADP [38]. Nearly all epidemiological research on the impact of flavonoids on cardiovascular diseases is inconclusive and calls for more research [39]. However, one of the rare studies confirming the beneficial effects of flavonoids in cardiovascular diseases was one performed by Wang et al. [40]. Meta-analysis of published data from 1966 to 2013 shows that an increase in flavanol intake by 20 mg per day reduces the risk of stroke by 14 % in men. The same effect was not confirmed in females.

Rosmarinic acid (AR) is a purely natural compound derived from herbs belonging to the Lamiaceae family, such as Rosemary, sage, basil, and mint. These plants are widely and frequently utilized in recipes for food. Rosmarinic acid is an ester of caffeic acid and 3,4-dihydroxy phenyl lactic acid. The biological benefits of chronic RA use on cardiometabolic abnormalities have been revealed. Rosmarinic acid reduces blood pressure by inhibiting of angiotensin-converting enzyme (ACE). (ACE) [41], promotes nitric oxide production and regulates endothelin-1 (ET-1) production, and downregulates endothelin-1 (ET-1) production [42]. Chronic treatment with RA improves whole-body insulin sensitivity in fructose-fed hypertensive rats [43] and high-fat diet (HFD)-induced diabetic rats [44]. It also reversed streptozocin-induced decreases in skeletal muscle plasma membrane GLUT-

4 content in diabetic rats [44]. However, the mechanisms through which RA increases glucose uptake need to be elucidated. Angiotensin II (ANG II) is a potent hypertensive agent. It is involved in the generation of reactive oxygen species (ROS) that activate p38 MAPK, reduce Akt phosphorylation, and decrease GLUT-4 translocation in skeletal muscles [45, 46]. The antioxidant properties of RA inhibit the production of ROS via c-Jun N-terminal kinase (JNK) and extracellular signal-regulated kinase (ERK) in a cell death model of cardiac muscle [47]. A previous study reported that ERK plays a crucial role in the therapeutic actions of RA in the hippocampus [48]. Moreover, exercise and 5-aminoimidazole-4-carboxamide-1-beta-d-riboside (AICAR) increase skeletal muscle glucose transport through the activation of ERK and adenosine monophosphate-activated protein kinase (AMPK) activities [49]. Together, RA might induce skeletal muscle glucose transport via the ERK pathway. In addition, RA could improve both cardiovascular and metabolic problems in hypertensive conditions. Therefore, this study aimed to evaluate the effects of acute and chronic RA administration on blood pressure and skeletal muscle glucose transport in rats treated with ANG II. Moreover, this study assessed the signaling pathways involved in skeletal muscle glucose transport.

VI. Treatment Regimen

The dosage of rosemary essential oil of 1 ml every eight hours has been indicated according to the German Commission E monograph on rosemary essential oil, as well as the safety profile derived from its use in its clinical and traditional use [50]. Rosemary essential oil samples were purchased by Meta pharmaceutical (Barcelona, Spain). The main components were 1,8-cineol (47.6%), camphor (13.8%), and α-pinene (11.7%), which corresponds to a Moroccan-type rosemary oil. The minor components were β-pinene, camphene, borneol, limonene, α-terpineol, p-cymene, β-myrcene, bornyl acetate, and verbenone. Rosemary essential oil and placebo were supplied in 30ml vials. made of topaz-colored glass with a dropper. Patients received the corresponding dose by dropping 1 ml on a sugar cube to avoid an unpleasant taste. Sugar cubes to avoid any unpleasant taste[51].This study is a part of many others works on the valorization of natural products started since 2006 [52-84].

VII. Conclusion

The antihypertensive and cardiovascular disease-stimulating effects of rosemary essential oil are shown in this work, along with the corresponding improvement in patients' quality of life. The study, which was conducted in a pharmacy, allowed for the evaluation of both the therapeutic efficacy and the significance of pharmaceutical care in patient compliance. The findings of this study can act as a roadmap for future investigations aimed at advancing scientific understanding of widely used plants.

Acknowledgments

The authors would like to thank you for the financial support of the project ANPMA/CNRST/UMP/VPMA347 /20 entitled “Fungal, insecticide, or acaricide formulations of essential oils of aromatic and medicinal plants and their extracts”.

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Global Journal of Science Frontier Research: B Chemistry
Volume 23 Issue 2 Version 1.0 Year 2023
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Microbial Polymers, Natural Pesticides, and Environmental Protection from Chemical Pollutants

By Amany M. Basuny, Moustafa A. Aboel-Ainin & Esraa Hassan

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Abstract- Through this article, we offer you to highlight the important and vital role of microbial polymers by identifying them, their types, and their different uses in industry and agriculture, and how to extract them from microbial environments in different ways. The interest in this topic comes from the global concern based on preserving the environment and not using chemicals represented in pesticides and chemical fertilizers and their harmful effects on the environment, climate changes and global warming, and among them comes the interest in using natural materials produced by microbes, which have a good effect on the environment and at the same time disposal Security from harmful pests using environmentally safe natural pesticides.

Keywords: microbial polymers, natural pesticides and environmental protection.

GJSFR-B Classification: DDC Code: 344.046 LCC Code: K3585

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Abstract- **Through this article, we offer you to highlight the important and vital role of microbial polymers by identifying them, their types, and their different uses in industry and agriculture, and how to extract them from microbial environments in different ways. The interest in this topic comes from the global concern based on preserving the environment and not using chemicals represented in pesticides and chemical fertilizers and their harmful effects on the environment, climate changes and global warming, and among them comes the interest in using natural materials produced by microbes, which have a good effect on the environment and at the same time disposal Security from harmful pests using environmentally safe natural pesticides.**

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I. Polymers Definition

Polymer, any of a class of natural or synthetic substances composed of very large molecules, called macromolecules, that are multiples of simpler chemical units called monomers. Polymers make up many of the materials in living organisms, including, for example, proteins, cellulose, and nucleic acids. Moreover, they constitute the basis of such minerals as diamond, quartz, and feldspar and such man-made materials as concrete, glass, paper, plastics, and rubbers.

The word polymer designates an unspecified number of monomer units. When the number of monomers is very large, the compound is sometimes called a high polymer. Polymers are not restricted to monomers of the same chemical composition or molecular weight and structure. Some natural polymers are composed of one kind of monomer. Most natural and synthetic polymers, however, are made up of two or more different types of monomers; such polymers are known as copolymers.

II. Types of Polymers

There are several types of polymers. Among the main ones are: natural, synthetic, addition, condensation and rearrangement. For more detailed information about each, check out the descriptions below!

a) Natural polymers

Natural polymers are all those found in nature. Among the main examples are rubber, polysaccharides, starch, glycogen and proteins.

b) Synthetic polymers

Synthetic or artificial polymers are manufactured in the laboratory and generally have petroleum-derived ingredients. The best-known examples of this option are: polystyrene, methyl polymethacrylate (acrylic), polypropylene, polyethylene and polyvinyl chloride (PVC).

c) Addition polymers

This compound is obtained by successively adding monomers. As examples of these polymers, we have polysaccharides, which are formed by monomers of monosaccharides, and proteins, which are produced by amino acid monomers.

d) Condensing polymers

The condensing polymers are obtained by adding two different monomers with the elimination of a molecule of acid, alcohol or water during the polymerization process.

e) Rearrangement polymers

The rearrangement polymers are the result of the reaction between the monomers that undergo rearrangement and their chemical structures throughout polymerization. An example of this is polyurethane.

f) Biodegradable polymers

Finally, biodegradable polymers degrade into biomass, water and carbon dioxide as a result of the action of enzymes or living organisms. Under favorable conditions, they can be degraded in a few weeks.

III. History of Bacterial Polymers

The first discovery of a bacterial polymer dates back to the mid nineteenth century, when Louis Pasteur discovered dextran as a microbial product in wine124. Van Tieghem125 then identified the bacterium (Leuconostoc mesenteriodes) that is responsible for dextran formation. This discovery was followed by the

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finding, in 1886, that cellulose is produced by bacteria126. Shortly after the discovery of these exopolysaccharides, the first intracellular reserve polymers were discovered, such as the polyamide cyanophycin in cyanobacteria127 and, 40 years later, the polyester polyhydroxybutyrate in Bacillus megaterium128. Most other industrially and medically relevant bacterial polymers were found in the early to mid twentieth century, such as alginate129, xanthan130, poly-g-glutamate131 and polyphosphate132. Shortly after the discovery of the various biopolymers, the activities of their biosynthesis enzymes (either purified or in cell extracts) were described, and radioisotope-labelled precursors were also used to elucidate some details about the metabolic pathways for biopolymer formation133–140.

Between 1970 and 2000, the advent of gene-cloning techniques and DNA-sequencing methods enabled the identification of biosynthesis genes, such as the cyanophycin synthetase gene (cphA) 58, and gene clusters, such as those found in the Pseudomonas aeruginosa genome76,77,141–144. It is striking that around two decades after the identification of genes and gene clusters involved in the biosynthesis of well-established polymers (for example, cellulose and alginate) the functional assignment of essential genes is still lacking10,145. Moreover, the reaction mechanisms of key enzymes, including various synthases, synthetases and polymerases, as well as the functions of co-polymerases and polymerase subunits and of proteins involved in polymer export and secretion (such as polysaccharide transporters, secretins and translocons) are still poorly understood.

IV. Production of Microbial Polymers for Food Industry

Natural polymers can be classified as microbial-, plant-, and animal-derived based on their sources. High cost of downstream processes of plant and algal gums drives the polymer industry toward microbial derived polymers. Furthermore, microbial polysaccharides generally have higher molecular weights than plants, which affect their properties (Oner et al. 2016).

Current discoveries in microbial polymer biosynthesis have initiated new areas for medical and industrial applications. Novel molecular mechanisms and production processes have been discovered. These molecular mechanisms have formed important tools for process engineering and applications, which are getting popular in pharmaceutical, agriculture, and particularly, in food industry.

Microbial polymers are long-chained, natural, biodegradable, biocompatible, nontoxic materials and are easy to handle compared to synthetic polymers. Xanthan gum, dextran, alginate, bacterial cellulose, gellan, curdlan, levan, pullulan, glycogen are important microbial polysaccharides that can be of bacterial or fungal origin (Vijayendra and Shamala 2014).

Generally, water-soluble polymers are used as suspending, gelling, and thickening agents in food industry. Polymers can also add characteristics such as sweetening, cryoprotection, antioxidant, anticaking, flavoring, antifoaming, chelating, stabilizing, preservative, and coating (Rosalam and England 2006).

a) Production Processes for Levan

Levan is an unusual fructan homopolysaccharide composed of β-(2,6)-fructo-furanosyl residues with a terminal d-glucopyranosyl unit. Levan is synthesized from various bacteria such as Acetobacter, Aerobacter, Azotobacter, Bacillus, Erwinia, Gluconobacter, Pseudomonas, Streptococcus, Zymomonas and Halomonas sp. (Kazak Sarilmiser et al. 2015). Extremophilic and gram- negative Halomonas sp. was reported as first levan producer in 2009 by Poli et al. This system is very promising compared to mesophilic producers because it enables unsterile, low-cost production (Oner et al. 2016). Halomonas levan and its derivatives can be used as bioflocculating agent (Sam et al. 2011), adhesive nanostructured multilayer films (Costa et al. 2013), heparin-mimetic bioactive material (Erginer et al. 2016), and temperature sensitive hydrogels for drug-releasing systems with pNIPA (Osman et al. 2017) among many others.

b) Production Processes of Pullulan

Pullulan is a natural, water soluble, linear homopolysaccharide composed out of maltotriose units. Maltose molecules are linked by α (1→4) glycosidic bonds, while consecutive maltotriose units are linked by α (1→6) glycosidic bonds. Pullulan was discovered in the late 1950s and isolated froma polymorphic fungus called Aureobasidium pullulans. It has been commercially produced since 1976. This homopoly-saccharide has been used in many studies and applications involving cosmetics, pharmaceuticals, and food industries.

Pullulan is a biopolymer that is synthesized within the cell and then excreted on the outer layer after production. Like many biopolymers, the main disadvantage is a high production cost. Therefore, the research has been shifted to the use of for the production process (Prajapati et al. 2013; Wang et al. 2015; Wu et al. 2016).

Characteristics of pullulan are highly dependent on fermentation parameters, fungal strain, and its morphology. Even though many studies have been carried out to find a relationship between the morphology of the fungus and the characteristics of pullulan, no definitive evidence has been found yet. The content of the fermentation medium is crucial for the optimal polymer yield. Commercial fermentation media are composed of peptone, phosphate, and basal salts.

c) Production Processes for Alginate

Alginate is a polysaccharide composed of β-D-mannuronate and α-L-guluronate linked by 1,4 glycosidic bonds. Alginate was initially collected from brown seaweeds and has been commercially available since the beginning of the twentieth century. Alginate is produced by several different species of brown seaweed and two different species of bacteria; Pseudomonas and Azotobacter.

Microbial production has benefits over algal production such as low cost, ability of production in small scales and applied in different fields. As mentioned previously, bacterial alginate can be obtained using Pseudomonas and Azotobacter; for commercial alginate production, human pathogen Pseudomonas aeruginosa and soil bacteria Azotobacter vinelandii are most widely preferred (Sabra and Zeng 2009; Hay et al. 2013; Ahmad et al. 2015).

Microbial production of alginate can be obtained through batch, fed-batch, and continuous fermentation. Epimerases lyases and acetyase enzymes are the important alginate modifying enzymes that were reported previously (Høidal et al. 2000).

d) Production Processes for Curdlan

Curdlan is a linear bacterial exopolysaccharide and classified as (1, 3) β-glucans. Curdlan is a special polysaccharide due to its rheological properties, solubility, and biomedical characteristics. Curdlan is named after its "curdle" competence when heated. Parameters such as pH, nitrogen, carbon, oxygen, and phosphate levels affect the production yields of curdlan. Curdlan is an extracellular polymer and biosynthesis occurs in three different steps. Substrate utilization, followed by intracellular metabolism of utilized substrate and finally excretion of polymer out of the cell membrane (Sutherland 1977, Zhang and Edgar 2014).

e) Production Processes for Gellan Gum

Gellan is a bacterial polysaccharide produced by Sphingomonas elodea. It belongs to a group of polysaccharides called sphingans, named by the bacteria from which it is produced. This biopolymer is an anionic, linear polysaccharide with high molecular weight composed out of D-glucose, L-rhamnose, and D-glucuronic acid in molar ratios of 2: 1: 1 (Tako 2015).

Production of gellan begins with the isolation of the bacterium from the surface of a plant belonging to Elodea genus. Gellan production is accomplished via fermentation with immersion method. The medium used for incubation contains nitrogen, carbon sources, and some crucial trace minerals.

f) Production Processes of Xanthan Gum

Xanthan is a complex exopolysaccharide synthesized by plant-pathogenic bacterium Xanthomonas campestris. Exopolysaccharides produced by these pathogenic bacteria have a characteristic feature of protection against adverse environmental conditions such as drying, temperature oscillations, radiation, and adhesion (Luvielmo et al. 2016).

Xanthan gum is commonly applied as a thickening and stabilizing agent in different types of food and industrial products. The process of production of xanthan includes several steps. First, the chosen microbial is grown on solid media or in liquid media and used to inoculate the culture in large bioreactors. The mode of operation, medium composition, type of bioreactor, temperature, pH, and dissolved oxygen concentration influence both the microorganism growth and xanthan production. At the end of the fermentation, cells are usually removed via filtration or centrifugation operations from the culture broth that contains xanthan, bacterial cells, and numerous other chemicals. Next step is purification, where precipitation can also be included by using water-miscible nonsolvent, followed by the addition of certain salts and pH adjustments. The product is then mechanically dewatered and dried. The dried product is milled and packed into containers with a low permeability to water.

g) Production Processes of Dextran

Dextrans are a group of homopolysaccharides composed of a linear chain of α-(1, 6) glycosidic linkages that may form branches on the main chain. It was first observed by Louis Pasteur, but this bioploymer's potential in food industry was not investigated until the 1950s. Dextran is one of the oldest bacterial polysaccharides with a multitude of functions.

Dextran is an exopolysaccharide synthesized by Streptococcus, Lactobacillus, and some Weisella species and is very sensitive to environmental conditions like substrate concentration, pH, temperature, and salinity. Because different strains of bacteria belonging to the same species can produce dextran with varying structures, it is, in theory, possible to produce dextran according to specific needs. For example, keeping the substrate levels low tends to give dextran a higher molecular weight (Das and Goyal 2014; Zannini et al. 2016; Baruah et al. 2017).

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Plagiarism is not acceptable in Global Journals submissions at all.

Plagiarized content will not be considered for publication. We reserve the right to inform authors' institutions about plagiarism detected either before or after publication. If plagiarism is identified, we will follow COPE guidelines:

Authors are solely responsible for all the plagiarism that is found. The author must not fabricate, falsify or plagiarize existing research data. The following, if copied, will be considered plagiarism:

- Words (language)
- Ideas
- Findings
- Writings
- Diagrams
- Graphs
- Illustrations
- Lectures

- Printed material
- Graphic representations
- Computer programs
- Electronic material
- Any other original work

Authorship Policies

Global Journals follows the definition of authorship set up by the Open Association of Research Society, USA. According to its guidelines, authorship criteria must be based on:

1. Substantial contributions to the conception and acquisition of data, analysis, and interpretation of findings.
2. Drafting the paper and revising it critically regarding important academic content.
3. Final approval of the version of the paper to be published.

Changes in Authorship

The corresponding author should mention the name and complete details of all co-authors during submission and in manuscript. We support addition, rearrangement, manipulation, and deletions in authors list till the early view publication of the journal. We expect that corresponding author will notify all co-authors of submission. We follow COPE guidelines for changes in authorship.

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Appealing Decisions

Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

Acknowledgments

Contributors to the research other than authors credited should be mentioned in Acknowledgments. The source of funding for the research can be included. Suppliers of resources may be mentioned along with their addresses.

Declaration of funding sources

Global Journals is in partnership with various universities, laboratories, and other institutions worldwide in the research domain. Authors are requested to disclose their source of funding during every stage of their research, such as making analysis, performing laboratory operations, computing data, and using institutional resources, from writing an article to its submission. This will also help authors to get reimbursements by requesting an open access publication letter from Global Journals and submitting to the respective funding source.

Preparing your Manuscript

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.

Manuscript Style Instruction (Optional)

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11'", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

Structure and Format of Manuscript

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

a) A title which should be relevant to the theme of the paper.
b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
d) An introduction, giving fundamental background objectives.
e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
f) Results which should be presented concisely by well-designed tables and figures.
g) Suitable statistical data should also be given.
h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
j) There should be brief acknowledgments.
k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.

Format Structure

It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

All manuscripts submitted to Global Journals should include:

Title

The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

Author details

The full postal address of any related author(s) must be specified.

Abstract

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Keywords

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, “What words would a source have to include to be truly valuable in a research paper?” Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for Writing a Good Quality Science Frontier Research Paper

Techniques for writing a good quality Science Frontier Research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of science frontier then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.

6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

Administration Rules to Be Strictly Followed before Submitting Your Research Paper to Global Journals Inc.

Please read the following rules and regulations carefully before submitting your research paper to Global Journals Inc. to avoid rejection.

Segment draft and final research paper: You have to strictly follow the template of a research paper, failing which your paper may get rejected. You are expected to write each part of the paper wholly on your own. The peer reviewers need to identify your own perspective of the concepts in your own terms. Please do not extract straight from any other source, and do not rephrase someone else's analysis. Do not allow anyone else to proofread your manuscript.

Written material: You may discuss this with your guides and key sources. Do not copy anyone else's paper, even if this is only imitation, otherwise it will be rejected on the grounds of plagiarism, which is illegal. Various methods to avoid plagiarism are strictly applied by us to every paper, and, if found guilty, you may be blacklisted, which could affect your career adversely. To guard yourself and others from possible illegal use, please do not permit anyone to use or even read your paper and file.

Criterion for Grading a Research Paper (Compilation) by Global Journals

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

INDEX

Global Journal of Science Frontier Research

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ISSN 9755896