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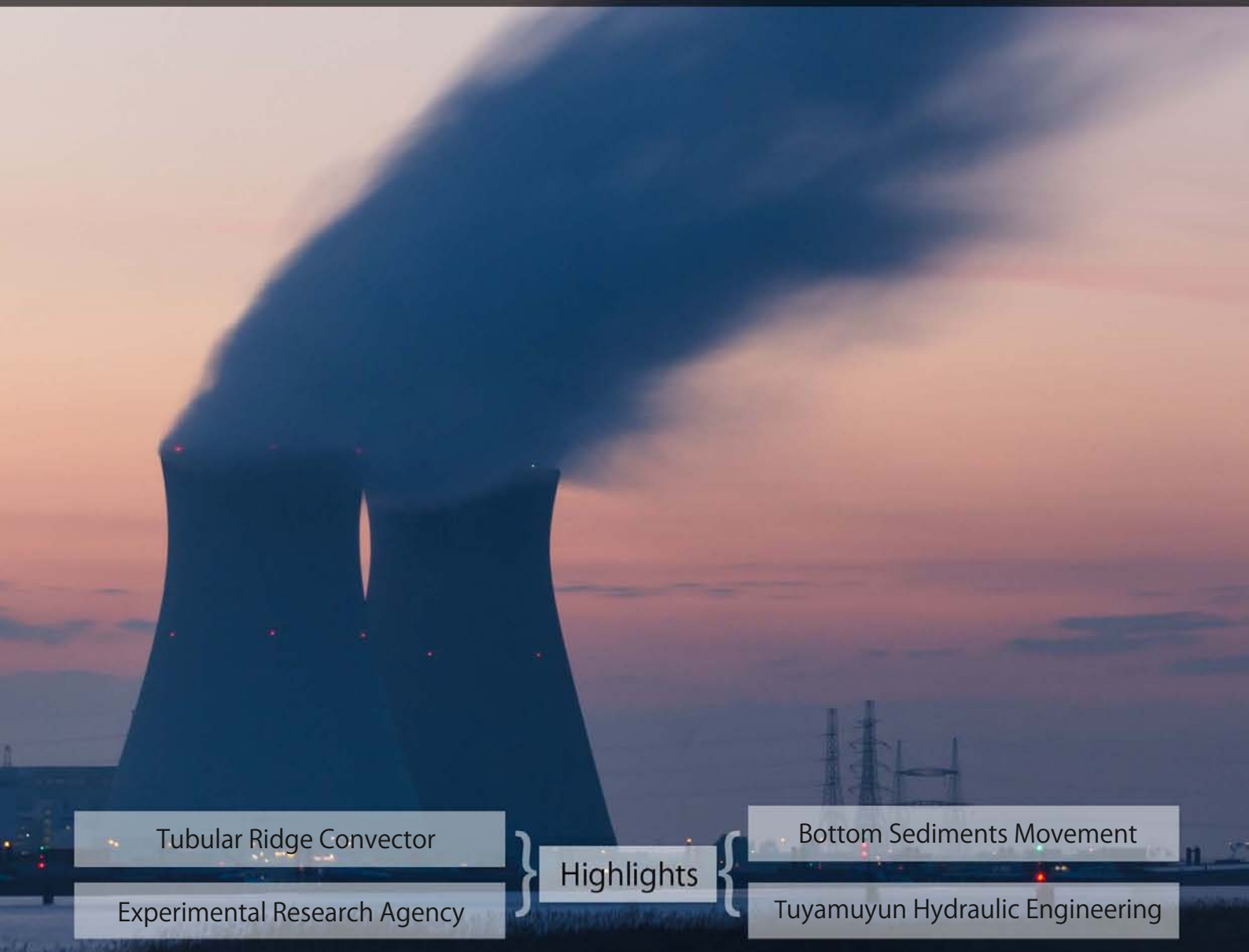

Highlights

Tubular Ridge Convector

Experimental Research Agency

Bottom Sediments Movement

Tuyamuyun Hydraulic Engineering

Discovering Thoughts, Inventing Future

VOLUME 21 ISSUE 2 VERSION 1.0

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Experimental Research Agency of Fouling on Heat Rating of the Tubular Ridge Convector

By Sukhotski Albert
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Abstract- The experimental research of intensity of a thermal stream and distribution of temperatures on ribbed pure and low-purity surface of the tubular ridge convector with spiral aluminium ribs is spent at air free convection. Researches were spent by a method of full thermal model testing at specially developed experimental stand, and ring uniform pollution ribbed tubes was created by dense winding between ribs of a linen cord or wrapping of tube by an aluminium foil.

It is revealed that at a free convection in tubes with a close arrangement of ribs of pollution of intercostal space at the basis **оребрения** does not lead to essential decrease in a heat rating (less than 10 %), and the decline to give heat properties of a tube occurs only at pollution of cops ribbed (on 20,5 %). The temperature on altitude of a lateral surface of a rib decreases slightly (less than 2 %), and on a rib cop in relation to the basis - for 6-9 %. Hence, at maintenance of ridge convectors of systems of heating their frequent and careful clearing of pollution is not obligatory.

Keywords: bimetallic ribbed tube, convector, pollution, heat rating at air free convection.

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Experimental Research Agency of Fouling on Heat Rating of the Tubular Ridge Convector

Экспериментальное исследование влияние внешнего загрязнения на тепловую мощность трубчатого ребристого конвектора

Sukhotski Albert

Abstract- The experimental research of intensity of a thermal stream and distribution of temperatures on ribbed pure and low-purity surface of the tubular ridge convector with spiral aluminium ribs is spent at air free convection. Researches were spent by a method of full thermal model testing at specially developed experimental stand, and ring uniform pollution ribbed tubes was created by dense winding between ribs of a linen cord or wrapping of tube by an aluminium foil.

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Keywords: bimetallic ribbed tube, convector, pollution, heat rating at air free convection.

Абстрактный- **Проведено экспериментальное исследование интенсивности теплового потока и распределение температур на оребренной чистой и загрязненной поверхности трубчатого ребристого конвектора со спиральными алюминиевыми ребрами при свободной конвекции воздуха. Исследования проводились методом полного теплового моделирования на специально разработанном экспериментальном стенде, а кольцевое равномерное загрязнение оребренной трубы создавалось путем плотной намотки между ребрами льняного шнура или обертыванием трубы алюминиевой фольгой.**

Обнаружено, что при естественной конвекции в трубах с тесным расположением ребер загрязнения межреберного пространства у основания оребрения не приводит к существенному снижению тепловой мощности (менее 10%), а ухудшение теплоотдающих свойств трубы происходит только при загрязнении верхушек оребрения (на 20,5%). Температура по высоте боковой поверхности ребра уменьшается незначительно (менее 2%), а на верхушке ребра по отношению к основанию – на 6–9%. Следовательно, при эксплуатации ребристых конвекторов систем отопления не обязательна их частая и тщательная очистка от загрязнения.

Ключевые слова: биметаллическая ребристая труба, конвектор, загрязнение, тепловая мощность при естественной конвекции воздуха.

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I. Введение

Во многих странах, в том числе и России, расширяется применение в системах отопления трубчато-ребристых нагревательных приборов – конвекторов, которые характеризуются малой инерционностью и металлоемкостью, простотой изготовления, возможностью механизировать и автоматизировать их производство [1, 2]. Одним из видов конструктивного исполнения конвектора является биметаллическая труба с круглыми алюминиевыми ребрами. Площадь внешней поверхности ребристой трубы во много раз больше, чем площадь поверхности гладкой трубы того же диаметра и длины, что придает отопительному прибору особую компактность. К недостаткам конвекторов относится трудоемкость очистки от пыли. При эксплуатации конвектора происходит снижение его тепловой мощности в результате загрязнения внутренней и наружной теплообменной поверхности.

Методики теплогидравлического расчета оребренных биметаллических труб для вынужденной и свободной конвекции приведены во многих источниках [3–9]. В справочной литературе [3, 4] имеется достаточно большое количество проверенных практикой данных по величине термического сопротивления движущихся внутри трубы различных охлаждаемых технологических энергоносителей. Подходы к учету внешнего загрязнения представлены только для вынужденной конвекции и принципиально противоположные. По мнению [4, 5] влияние загрязнения с воздушной стороны можно не учитывать, так как коэффициент теплоотдачи от оребрения к охлаждающему воздуху низок и поэтому термическое сопротивление теплоотдачи с внешней стороны является определяющим в общем термическом сопротивлении теплопередачи. Однако натурные экспериментальные исследования [10, 11] теплопередачи аппаратов воздушного охлаждения из биметаллических ребристых труб с накатанными алюминиевыми ребрами указывают на уменьшение от внешнего загрязнения оребрения коэффициента теплопередачи до 12% при вынужденной конвекции.

Разработаны также теоретические модели расчета коэффициента теплопередачи оребренной биметаллической трубы с кольцевым равномерным загрязнением [12–15] для разреженных круглых ребер, которые, однако, не подтверждены экспериментальными данными.

Цель работы – экспериментальное исследование интенсивности теплового потока и распределение температур на оребренной чистой и загрязненной поверхности круглоребристой трубы при свободной конвекции воздуха.

II. Основная Часть

Объектом исследования являлась биметаллическая ребристая труба со спиральными накатными ребрами. Материал ребристой оболочки – алюминиевый сплав АД1М, материал несущей трубы – углеродистая сталь Ст10. Диаметр несущей трубы $d_н$ = 25 мм, толщина стенки δ = 2 мм. Геометрические параметры оребрения, мм: наружный диаметр ребра d = 56 мм; высота ребра h = 14,6 мм; диаметр по основанию ребра $d_0 = d - 2h$ = 26,8 мм; шаг ребра s = 2,5 мм; средняя толщина ребра Δ = 0,5 мм; коэффициент оребрения трубы ф = 19,26. Полная длина биметаллической трубы с торцевыми участками 330 мм, теплоотдающая длина – l = 300 мм.

Исследования проводились методом полного теплового моделирования на специально разработанном в [16] экспериментальном стенде для исследования свободно-конвективного теплообмена. В центре стендовой камеры размером 0,8×0,8×1 м размещалась исследуемая оребренная труба, которая являлась калориметром с установленными средствами измерения.

Конструкция опытной трубы-калориметра представлена на рис. 1. Внутри биметаллической ребристой трубы *1*, указанной выше, установлен трубчатый электронагреватель (ТЭН) *2* со следующими параметрами: диаметр – 12,5 мм, длина 320 мм, мощность 320 Вт. Внутри оболочки ТЭНа, выполненного из углеродистой стал и, размещена спираль *3* из проволока с высоким омическим сопротивлением и наполнитель (электротехнический периклаз марки ППЭ). С помощью центровочного кольца *4* обеспечивалась центральное расположение ТЭНа в трубе. А с целью устранения внутренних конвективных токов воздуха и равномерного прогрева ребристой трубы между ТЭНом и стальной стенкой трубы, засыпался кварцевый песок *5* дисперсным составом 0,16–0,32 мм. Торцы трубок герметизировались высокотемпературной силиконовой замазкой *6*.

Для измерения средней температуры поверхности калориметра у основания ребер $t_{осн}$ зачеканивалось свинцом пять медь-константановых термопар *7* вдоль образующей трубы, сдвинутых относительно друг друга на угловое расстояние 45°. Термопары были заложены у основания ребер вдоль образующей трубы по винтовой линии на половине окружности трубы, считая, что вторая половина имеет симметричное поле температур. Также на поверхности ребра, размещенного в центре трубы, припаивались четыре медь-константановые термопары *8* (диаметр провода 0,2 мм) с шагом 3,65 мм от основания по высоте 3,65 мм и последней термопарой размещенной на верхушке ребра (рис. 1, сечение *I*). Предварительно термопары были протарированы с точностью 0,1°С. Торцевые участки оребренной трубы защищены фторопластовыми втулками *9* наружным диаметром $d_{вт}$ = 45 мм, длиной $l_{вт}$ = 35 мм, глубиной $b_{вт}$ = 25 мм. С целью измерения торцевых потоков тепла на поверхности обеих втулок с противоположных сторон закреплялось по два спая общей 4-спайной медь-константановой дифференциальной термобатареи.

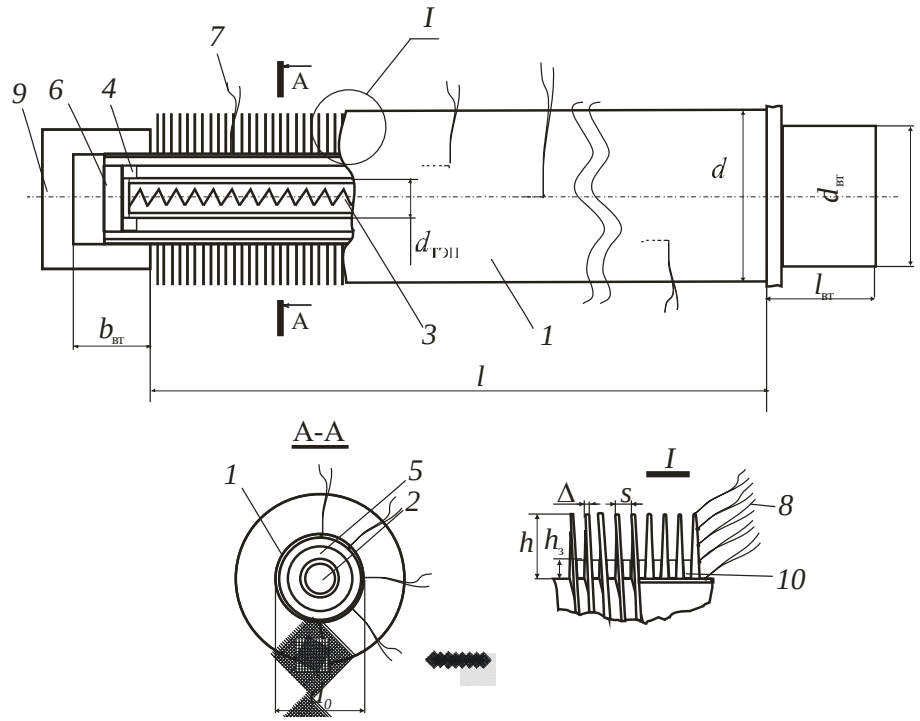

Рис. 1: Общий вид калориметрической трубы: *1* – биметаллическая ребристая труба; *2* – трубчатый электронагреватель (ТЭН); *3* – – спираль ТЭНа; *4* – центровочное кольцо; *5* – кварцевый песок; *6* – высокотемпературная силиконовая замазка; *7* – медь-константановые термопары у основания ребер; *8* – медь-константановые термопары по высоте ребра; *9* – фторопластовая втулка; 10 – льняной шнур

Показания медь-константановых термопар *7* и *8* фиксировались с помощью вольтметра (модель GDM-78341 класса точности 0,25), подключенного через переключатель. Холодный спай всех термопар помещался в сосуд Дьюара.

При исследовании кольцевое равномерное загрязнение оребренной трубы создавалось путем плотной намотки между ребрами льняного шнура *10* диаметром 1,7−2,3 мм, средней теплопроводностью $\lambda_з$ = 0,05 Вт / (м К). Таким образом, в межреберном пространстве создавался слой высотой $h_з$ = 3,3; 6,3; 8,7; 11,4; 16,1 мм с неравномерностью ±0,4 мм ((рис 2, *а*)).

а *б*

Рис. 2: Исследование кольцевого равномерного загрязнения оребренной трубы путем намотки льняного шнура *а* и обматыванием фольги *б*

Также, для обеспечения максимального термического сопротивления межреберного пространства, чистая оребренная труба герметично обматывалась алюминиевой фольгой толщиной 0,3 мм (рис 2, *б*). Таким образом, достигалось заполнение межреберного пространства неподвижным воздухом и обеспечивалось максимальное снижение тепловой эффективности ребристой трубы.

Подвод теплового потока к оребренным поверхностям обеспечивался ТЭНом, который подключался к регулируемому масляному трансформатору (модель АОМН-40-220-75). Мощность, подводимая к оребренной трубе, измерялась ваттметром (модель К 505 класса точности 0,5). Температура воздуха t_0 внутри камеры измерялась двумя ртутными лабораторными термометрами со шкалой 0−50°С и

ценой деления 0, 1°С, расположенными в диагонально противоположных ее углах. Ртутные шарики термометров защищались от излучения пучка экранами из алюминиевой фольги.

Теплота от оребренной поверхности конвекцией и излучением передавалась атмосферному воздуху, который за счет разности плотностей нагретого и холодного воздуха поднимался вверх в окружающую среду. Во время экспериментального исследования оребренной трубы электрическая мощность, подводимая к трубе, поддерживалась постоянной для льняного шнура $W = 40\pm2$ Вт и изменялась для воздуха $W = 10{,}3-77{,}5$ Вт , температура стенки у основания ребер составляла $t_{осн} = 80-94$°С, а температура окружающего воздуха в камере $t_0 = 18{,}4 - 20{,}1$°С.

Удельный тепловой поток q, Вт/м, на 1 м погонной длины конвектора отведенный от трубы к воздуху конвекцией и излучением, рассчитывался из уравнения

$$q = \left(W - Q_{\text{п}}\right) / l,$$

где $Q_{\text{п}}$ – тепловые потери через торцы труб и токоподводы (рассчитывались через ранее полученную экспериментальную зависимость по средней температуре на поверхности втулок), Вт.

Результаты экспериментов представлены на рис. 3, 4. На рис. 3 показана зависимость относительной тепловой мощности трубы q / $\Delta t_{осн}$ от термического сопротивления загрязнения $R_{з} = h_{з} / \lambda_{з}$, где $\Delta t_{осн} = t_{осн} - t_0$ – среднее увеличение температуры у основания оребрения над температурой окружающей среды. При размещении в межреберном пространстве неподвижного воздуха $h_{з} = h =$ 14,6 мм, а коэффициент теплопроводности воздуха $\lambda_{з}$ определялся в зависимости от средней температуре по поверхности ребра.

Как видно, при высоте загрязнения меньше высоты ребра ($h_{з} < h =$ 14,6 мм), тепловая мощность трубы уменьшается незначительно (менее 10%). При полном закрытии оребрения слоем загрязнения из льняного шнура ($h_{з} =$ 16,1 мм) тепловая мощность уменьшается на 20,5%. По-видимому, это обусловлено тем, что при естественной конвекции в трубах с тесным расположением ребер в межреберном пространстве у основания ребер воздух остается практически неподвижным и является естественным изолятором, а основной отвод теплового потока осуществляется с верхушек оребрения. Поэтому загрязнения межреберного пространства у основания оребрения не приводит к существенному снижению тепловой мощности, а ухудшение теплоотдающих свойств трубы происходит только при загрязнении верхней части оребрения. При изоляции межреберного пространства неподвижным воздухом тепловая мощность снижается до 55%.

Это предположение косвенно подтверждается путем сравнения относительной тепловой мощности оребренной трубы с тепловой мощностью гладкой трубы диаметром равной диаметру оребрения $d =$ 56 мм (на рис. 3 представлена в виде пунктирной линии), рассчитанной по [17]. Как видно, тепловые мощности чистой оребренной трубы и гладкой трубы сопоставимы, что подтверждает представление об интенсивном отводе тепла с верхушек ребер.

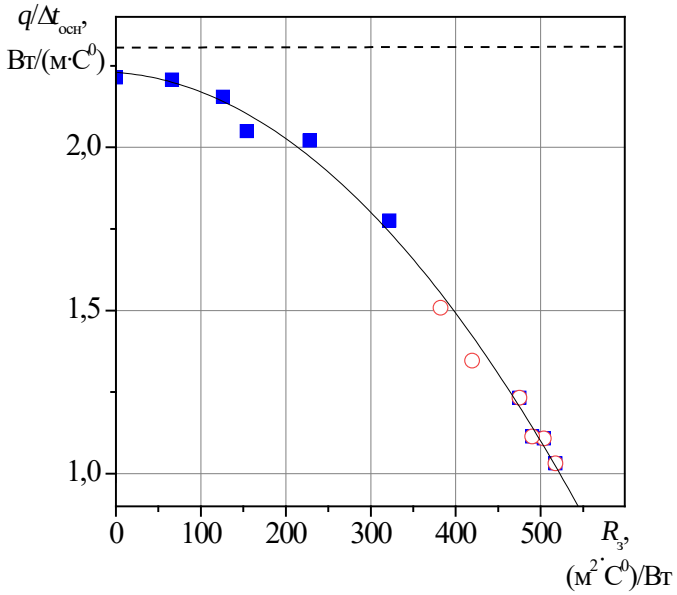

Рис. 3: Зависимость относительной тепловой мощности трубы $q / \Delta t_{осн}$ от термического сопротивления загрязнения $R_з = h_з / \lambda_з$: ! – льняной шнур, – – воздух

На рис. 4 представлены зависимости относительного перепада температуры $(t_р - t_0) / q$ по высоте ребра h для чистой и загрязненной оребренной трубы, где $t_р$ температура на поверхности ребра определенная термопарами 8 (рис. 1, сечение *I*). Пунктирной линией на рисунке показана граница раздела чистой и загрязненных областей оребренной поверхности (выше пунктирной области температуры $t_р$ определялись термопарами закрытыми загрязнением).

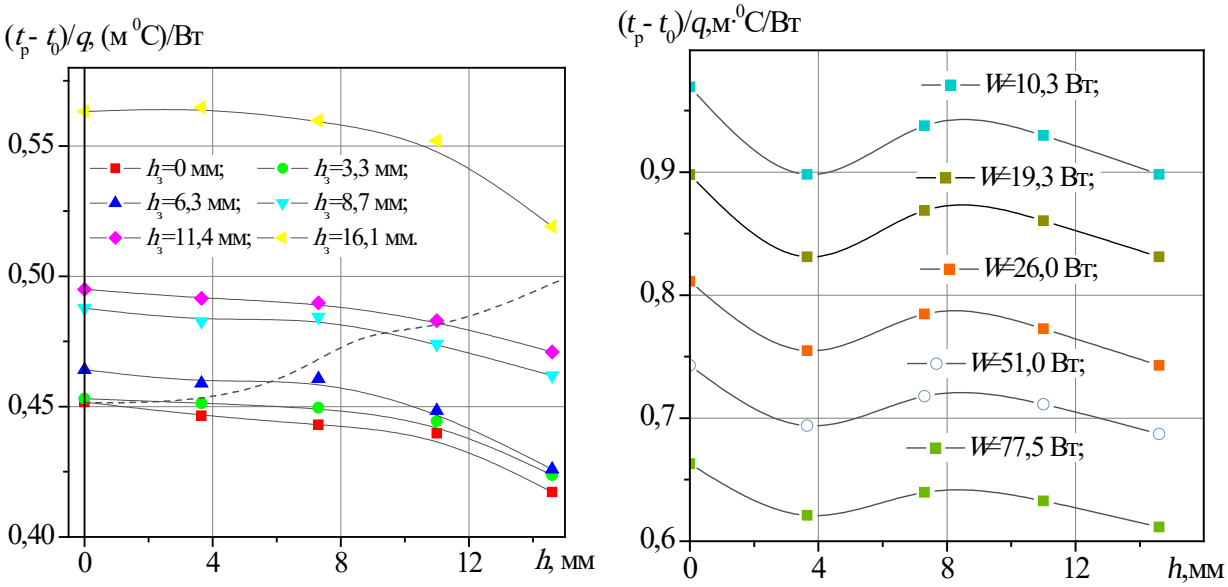

Рис. 4: Зависимости относительного перепада температуры $(t_р - t_0) / q$ по высоте ребра h для чистой ($h_з = 0$), загрязненной льняным шнуром *а* и неподвижным воздухом *б* оребренной трубы с высотой загрязнения $h_з$ и тепловой мощностью W: ! – $h_з$ = 0 мм, , – $h_з$ = 3,3 мм, 7 – $h_з$ = 6,3 мм, В – $h_з$ = 8,7 мм, Λ – $h_з$ = 11,4 мм, Ω – $h_з$ = 16,1 мм; ! – W = 10,3 Вт, ! – W = 19,3 Вт, ! – W = 26,0 Вт, – – W = 51,0 Вт, ! – W = 77,5 Вт

Как видно, температура по высоте боковой поверхности ребра уменьшается незначительно (менее 2%), а на верхушке ребра по отношению к основанию – на 6–9%.

III. Заключение

Проведено экспериментальное исследование интенсивности теплового потока и распределение температур на оребренной чистой и загрязненной поверхности круглой трубы при свободной конвекции воздуха.

При загрязнении оребренной поверхности только у основания ребер тепловая мощность теплообменной трубы уменьшается менее чем на 10%. Предельное загрязнение межреберного пространства неподвижным воздухом уменьшило тепловую мощность более чем в два раза. Следовательно, при эксплуатации трубчатых ребристых конвекторов не обязательна их частая и тщательная очистка от глубоких межреберных плотных загрязнений.

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Field Studies of the Bottom Sediments Movement in the Tuyamuyun Hydraulic Engineering Complex Lower Reaches of the Amu Darya River

By T Majidov & N Ikramov

Abstract- The study of sediment flow rates in eroded riverbeds has great practical importance, especially when solving a number of water management problems involving various hydraulic structures. It is important to take quantitative account of sediments in calculating the siltation of reservoirs, when solving issues of rational placement and design of water intake structures and channels that divert water from the river for irrigation and water supply needs. In the channels of watercourses, sediments are transported in a suspended state, distributed throughout the living cross-section of the stream and bottom sediments, moved in the bottom layer. Measuring the flow rate of bottom sediments in nature is much more difficult than measuring the flow rate of suspended sediments. Therefore, measurements of the flow rate of bottom sediments related to the geometric dimensions and dynamic characteristics of ridges are mainly studied in the laboratory. The article presents the object of research, the method of research and the results obtained for determining the flow rate of bottom sediments. Full-scale observations to determine the bottom, suspended and total sediment discharge were carried out in the lower reaches of the Tuyamuyun hydraulic engineering complex on the Amu Darya River, which flows through the territory of the Central Asian states.

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T Majidov[α] & N Ikramov[σ]

Abstract- The study of sediment flow rates in eroded riverbeds has great practical importance, especially when solving a number of water management problems involving various hydraulic structures. It is important to take quantitative account of sediments in calculating the siltation of reservoirs, when solving issues of rational placement and design of water intake structures and channels that divert water from the river for irrigation and water supply needs. In the channels of watercourses, sediments are transported in a suspended state, distributed throughout the living cross-section of the stream and bottom sediments, moved in the bottom layer. Measuring the flow rate of bottom sediments in nature is much more difficult than measuring the flow rate of suspended sediments. Therefore, measurements of the flow rate of bottom sediments related to the geometric dimensions and dynamic characteristics of ridges are mainly studied in the laboratory. The article presents the object of research, the method of research and the results obtained for determining the flow rate of bottom sediments. Full-scale observations to determine the bottom, suspended and total sediment discharge were carried out in the lower reaches of the Tuyamuyun hydraulic engineering complex on the Amu Darya River, which flows through the territory of the Central Asian states.

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I. Introduction

There are 56 reservoirs in the Republic of Uzbekistan with the volume of about 20 billion m3 of water filled from the Amu Darya, Syr Darya, Zeravshan, Chirchik, Surkhandarya, Naryn, Karadarya rivers and 28 large irrigation channels with flow rates of more than 100 m3/s diverting water from these rivers. In this regard, it is very important to determine the amount of sediment in water sources to calculate the volume of channel cleaning from sediment, as well as to calculate the volume of filling the reservoir with sediment, i.e. the useful volume.

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In the channels of watercourses, sediments are transported in a suspended state, distributed throughout the living cross-section of the stream and bottom sediments, moved in the bottom layer [1-10].To determine the amount of suspended sediment in the stream, samples are taken at hydrometric stations, and their concentration is determined in the laboratory by various methods [11-19].Measuring the flow rate of bottom sediments in nature is much more difficult than measuring the flow rate of suspended sediments.

Due to the complexity of direct measurement, many researchers propose to determine the flow rate of bottom sediments by a very approximate ratio between suspended and bottom sediments. For example, S.T. Altunin [20] recommends taking the flow rate of bottom sediments of the rivers of Central Asia based on the following percentages of the flow rate of suspended sediments: in mountainous areas - 15-23%, in foothill-5-15% and on the plains-1-3%. A. G. Khachatryan [21] and H. S. Shapiro [22] suggest that for the conditions of the Amu Darya, the flow of bottom sediments is equal to 10-11% of the flow of suspended sediments. V.E. Tuzov [23] expresses the opinion that the share of bottom sediment runoff varies both along the length of the river and in each section, depending on the water content of the year. For a high-water year, the flow rate of bottom sediments in the Tuyamuyun formation is recommended to be equal to 18% of the flow rate of suspended sediments, and for a low-water year, even 33%. This approach to determining the flow rate of bottom sediments is very approximate and uncertain.

A.I. Turaev and other researchers [24] determined the flow rate of bottom sediments of the Amu Darya by the volume of deformations or by the movement velocity of bottom sand ridges. Based on the data obtained, they established the percentage ratio of bottom and suspended sediment discharge for different sections of the Amu Darya River in different periods of the year. For example, for the target at the beginning of the water intake section of the Amu Bukhara Machine Canal (ABMC), the flow rate of bottom sediments is: when the flood rises (April-May) - from 3.5 to 75% of the suspended flow rate; in the flood (June-July) - from 2.0

to 19%, when the flood falls (August - September) - from 3.7 to 32.5 %. For the lines located below the ABMC, the bottom sediment consumption is 2.5-21.4 % of the corresponding suspended sediment consumption. Repeated measurement work on the Amu Darya with the calculation of the volume of channel deformations allowed V.E. Tuzov to derive a formula for calculating the flow rate of bottom sediments, which has become generally accepted:

II. Materials and Methods

The construction of water intake and reservoir nodes on rivers with an eroded channel violates the natural regime of their liquid and solid runoff. As a result of the backwater created by the nodes, a significant part of the river sediments is retained in their upper stream, and the clarified stream discharged through the culverts of the dam into the lower stream is gradually saturated with sediments due to deep and planned deformations.

The purpose of field studies is a preliminary forecast of the solid runoff flow rate, taking into account the moving ridge forms and changes in the turbidity of the Amu Darya River. The object of research is the alluvial regime and riverbed processes in the section of the Amu Darya riverbed with the length of 20 km below the Tuyamuyun hydraulic engineering complex. The beginning of the section was section 2, located 900 m below the spillway dam of the hydraulic engineering complex, and the end was section 64, located 4 km below the Tashsakadamless spillway node.

The channel of the Amu Darya River at the research site is composed of disjointed fine-sanded soils, the products of erosion of which in the form of bottom sediments are moved by a stream in the form of sand ridges. The movement of ridge forms was studied by visual observations. During the observations, the planned movements of the skewed ridge located in the section 64 were recorded. The ridge velocity was 18.3 m/day. This velocity should be considered overestimated, since the natural movement of the ridge was disrupted by the dredging operations carried out: a hole was dug in the riverbed to artificially change the direction of the current, the head of which was located at the distance of 200-250m from the crest of the observed ridge. The sharp increase in the slope of the water surface caused by digging led to an increase in the ridge movement velocity. In addition, since the section 64 is located at the distance of 3-4 km below the head regulator of the Tashsaka, as a result of water intake into the channel, the water consumption in the section 64 decreased, and the average size of sediment in it increased due to the intensive entrainment of the smallest particles of sediment into the regulator. For these reasons, the ridge formed in the section 64 did not correspond to the hydraulic regime of the flowing flow.

Similar observations were made for a skewed ridge in section 40, located 9.3 km downstream of the dam. The flow rate of water in the line is equal to the flow rate of releases to the lower stream. The horseshoe-shaped crest of the skewed ridge occupied the entire width of the riverbed. The tongue of the ridge was located at a distance of 1/38 from the left bank. The small turbidity of the water in the river made it possible to clearly distinguish the position of the ridge crest on the bottom up to a certain depth of the stream. At great depths of the stream, the outline of the ridge crest was traced by the pronounced difference in the free surface of the water, which was distinguished on this surface by an oblique dark line.

In the course of visual observations from the boat, not only the planned position of the ridge crest in the riverbed was determined, but also the ridge height was measured at 11 characteristic points. To determine the ridge movement velocity at these points of its crest, metal pegs with the length of 80 cm were fixed or a heavy load was placed. Then two floats were attached to the fixed points, connected by the 20 m long cord, one of which showed the position of the ridge at the initial moment of time, and the other - the direction of ridge movement and the water flow. The figure 1 shows the schematic plan for placing floats on the ridge crest under study. After fixing the time of setting the floats exactly after 1-3 days, the position of the ridge crest was measured in relation to the floats showing the initial position of the ridge, and based on changes in this position, the length of the path of movement of the ridge crest from the point under consideration was determined. The ridge movement velocity was determined by dividing the path length by the time intervals between observations (1-3 days). The ridge height was determined by the difference in the depth of water in its basement and on the ridge. The ridge length was taken as the distance from its crest to the crest of the ridge located downstream or upstream. The distance between the ridges of neighboring ridges was measured as follows: first, the planned outline of the ridge located above the studied one was established, and metal pegs were fixed on it, to which cords 50 m long were tied, ending in floats. After pulling the cords by the current, which showed its direction, metal pegs were installed above the floats, to which the upper ends of the cords were tied, which were untied from the pegs on the crest of the upper ridge. The described procedure was repeated until the crest of the studied ridge was reached.

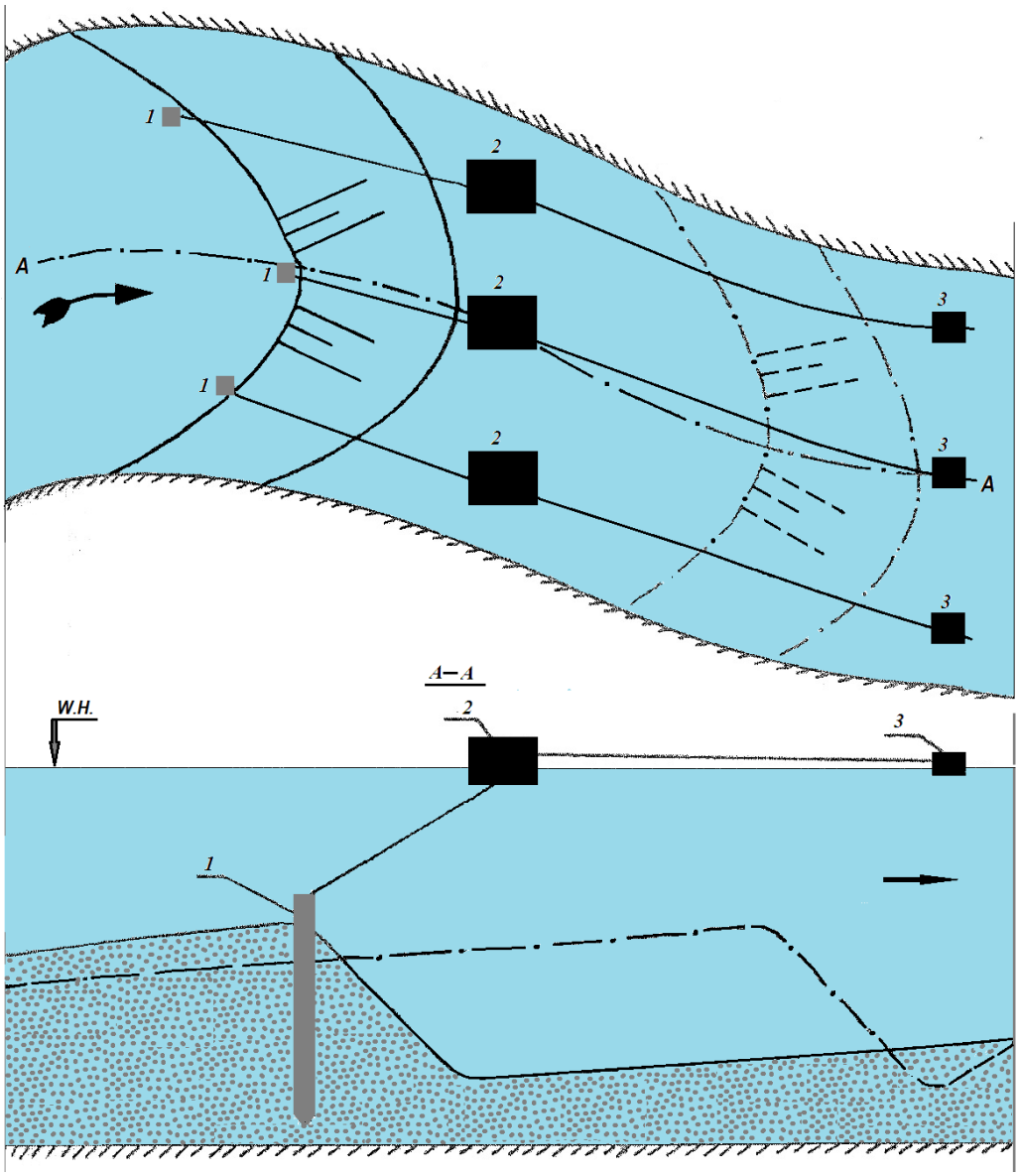

Fig. 1: Schematic layout of the floats in determining the ridge movement velocity:
1 - pegs or bottom cargo; 2-floats above the pegs; 3-floats to determine the direction of the flow of the stream.

III. Results and Discussion

The observations showed that the movement of the skewed ridge movement occurs mainly as a result of the movement of secondary smaller ridges on its surface, along the body of which, in turn, even smaller dune ridge forms move. Table 1 shows the average hydraulic characteristics of the flow and soil, as well as the parameters of the main and secondary ridges determined by field studies.

To determine the flow rate of bottom sediments, various measuring devices, calculation dependencies and methods are used. However, to date, there is no generally accepted method.

Table 1: Characteristics of the flow, soil and ridges in the section 40 on the Amu Darya riverbed

S. No.	Flow, sediment, and ridge characteristics	Dimension	Meaning
1	Water consumption at the time of observations	m^3/s	1380
2	Streamwidth	m	542
3	Averageflowdepth	m	2,45
4	Averageflowrate	m/s	1,02

5	Surfaceflowrate	m/s	0,833
6	Flowturbidity	g/m^3	48
7	Range of fractions change in the sample	mm	0,1÷2,0
8	Average size of bottom sediments	mm	0,270
9	Volume weight of sediment samples	g/cm^3	1,61
10	Height of the main ridge	m	1,65
11	Ridgelength	m	252
12	Ridge movement velocity	m/day	1,4
13	Ridgeshape	Skewed	-
14	The sediment size on the ridge crest	mm	0,110
15	The sediments size in the ridge basement	mm	0,250
16	Heightofsecondaryridges	m	0,21
17	Lengthofsecondaryridges	m	2,45
18	Formofsecondaryridges	RifflePlate	-

Since the bottom sediments movement occurs in the form of ridge forms in eroded channels, it is easy to calculate the amount of bottom sediment consumption by measuring the parameters of these forms and their movement velocity. The method of measuring ridges parameters was described in the works of a number of researchers [25-30]. One of the first analytical expressions of the elementary flow rate of bottom sediments in the ridge form belongs to M.A.Velikanov [31]:

$$q_r = \alpha \cdot h_r \cdot C_r, \quad (1)$$

Here: α - dimensionless coefficient, depending on the ridge shape and equal to 0.5-0.6;

h_r and C_r - height and movement velocity of the ridge.

To determine the flow rate of bottom sediments at one of the studied sub-sites, the parameters and ridges velocity were measured using a very unconventional method of visual observations. A small number of measurements did not allow us to establish the connection between the ridges parameters and the flow characteristics. It was difficult to use the existing formulas for calculating the ridges parameters due to the special conditions in the lower reaches of the Tuyamuyun hydraulic engineering complex. Therefore, the preliminary calculation of the flow rate of bottom sediments was carried out on the basis of the initial data of Table 1 according to the formula (1), which was supplemented with the measured values of the ridge height and its movement velocity.

There are three permanent hydrological posts at the research site, where samples are taken to determine the different characteristics of liquid and solid runoff. Data on the amount of suspended sediments were taken from the post "OGMS Tuyamuyun", located 9.3 km below (section 40) of the dam.

Calculation Example

1. Consumption of bottom sediments in the ridge form of movement.

Data for the calculation:

- Stream width, $B = 542$ m;
- Soil density, $\gamma = 1610$ kg/m^3;
- Ridge height, $h_r = 1,66$ m;
- Ridge movement velocity, $C_r = 0.0000162$ m/s;
- Ridge shape coefficient, $\alpha = 0.55$.

$$P_{bot} = \alpha \cdot h_r \cdot C_r \cdot \gamma \cdot B = 0,55 \cdot 1.66 \cdot 0.0000162 \cdot 1610 \cdot 542 = 12,91 \text{ kg/s}$$

$$P_{bot.\,day} = 12.91 \cdot 86400 = 1115.5 \text{t/day}$$

2. Suspended sediment consumption

Data for the calculation:

- Water consumption - $Q = 1380$ m^3/s;
- The turbidity of the flow is - $p = 0.048$ kg/m^3.

$$P_{sus} = Q \cdot p = 13\,80 \cdot 0.048 = 66.24 \text{ kg/s}$$

$$P_{sus.\,day} = P_{sus} \cdot T_{day} = 66.24 \cdot 86\ \ 400 = 723.14 \text{ t/day}$$

3. Total sediment consumption

$$P_t = P_{bot} + P_{sus} = 1115.4 + 5723.1 = 6838.6 \text{ t/day}$$

4. The proportion of bottom sediments from suspended sediments:

$$P\,\% = P_{bot.day} \cdot 100 / P_{sus.day} = 1115.4 \cdot 100 / 5723.1 = 19,5\%$$

Thus, during the observed period, the flow rate of bottom sediments moving in the form of bottom ridges was 19.5 % of the flow rate of suspended sediments.

IV. Conclusions

1. In the lower reaches of the Tuyamuyun hydraulic engineering complex, the bottom sediments movement occurs in the ridge form.
2. With clarified water in the lower reaches of hydraulic engineering units, the geometric and dynamic characteristics and ridges shapes, as well as the process of ridge formation, can be studied by direct observations and measurements.
3. In the riverbed at the research site, the bottom sediments movement occurs in the form of movement of skewed large ridges (mesoforms), along the body of which secondary ridges (riffles) move, in turn, covered with moving dune forms of ridges.
4. The calculation of the solid flow rate, based on the data of direct measurements of the geometric and dynamic parameters of the ridges, and the water turbidity, showed that for the moment of measurement, the flow rate of bottom sediments was 19.5% of the flow rate of suspended sediments.

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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.

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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

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