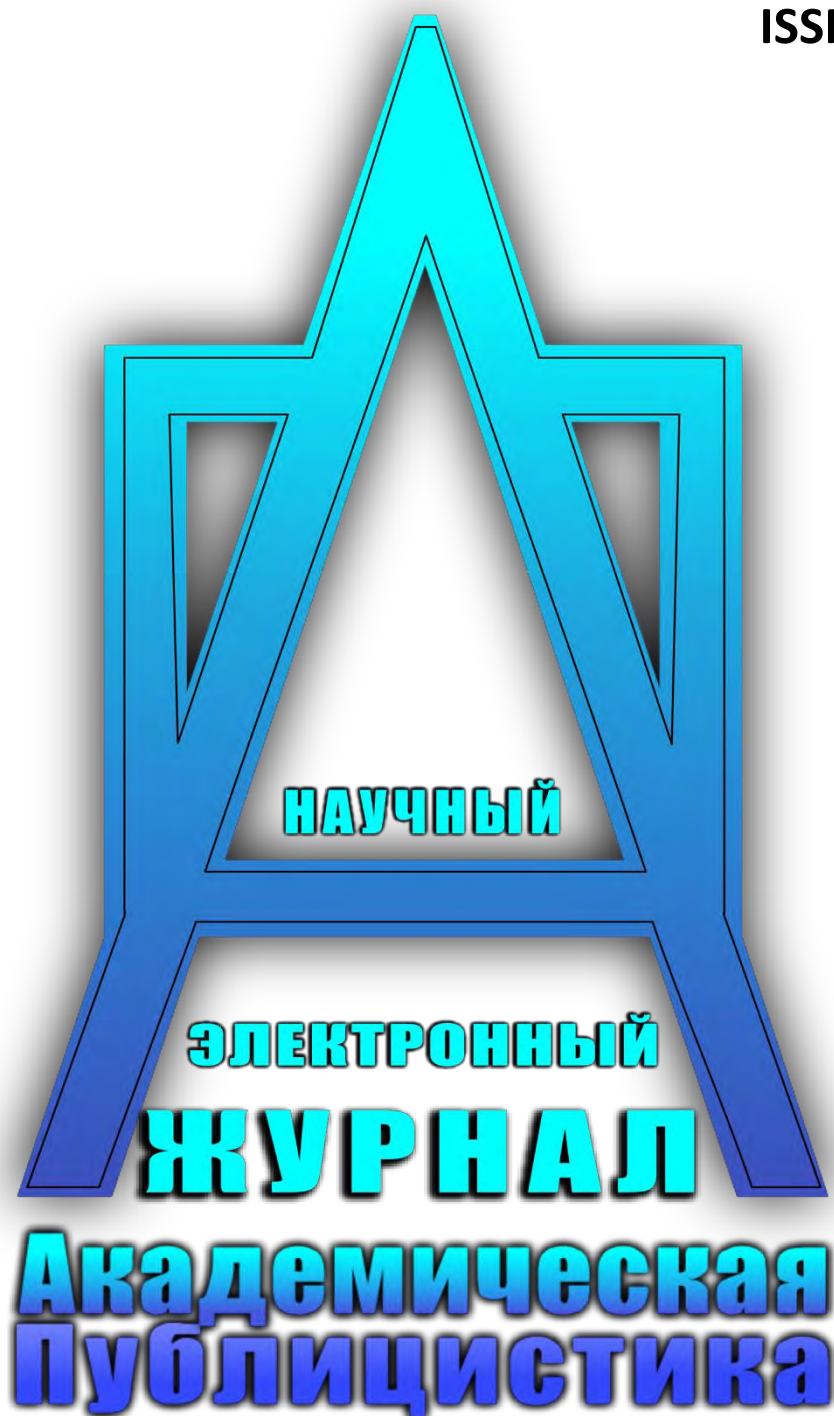


**АЭТЕРНА**

НАУЧНО-ИЗДАТЕЛЬСКИЙ ЦЕНТР

ISSN 2541-8076

№ 4-1/2023



# НАУЧНЫЙ ЭЛЕКТРОННЫЙ ЖУРНАЛ «АКАДЕМИЧЕСКАЯ ПУБЛИЦИСТИКА»

**ISSN 2541-8076**

Учредитель, издатель и редакция  
научного электронного журнала  
«Академическая публицистика»:  
Общество с ограниченной ответственностью «Аэтерна»  
450057, г. Уфа, ул. Пушкина 120  
+7 347 266 60 68  
<https://aeterna-ufa.ru>  
[info@aeterna-ufa.ru](mailto:info@aeterna-ufa.ru)

Верстка / корректура: Мартиросян О.В. / Некрасова Е.В.

Подписано для публикации на сайте  
<https://aeterna-ufa.ru>  
11.04.2023 г.

Формат 60x90/8.  
Усл. печ. л. 39.50.

Электронные текстовые данные (6,26 Мб).

Цена свободная.  
Распространяется по подписке.

**Все статьи проходят экспертную оценку.**

Точка зрения редакции не всегда совпадает с точкой зрения авторов публикуемых статей. Авторы статей несут полную ответственность за содержание статей и за сам факт их публикации. Учредитель, издатель и редакция не несет ответственности перед авторами и/или третьими лицами и организациями за возможный ущерб, вызванный публикацией статьи.

**При использовании и заимствовании материалов  
ссылка обязательна**

*Главный редактор:*

Сукиасян Асатур Альбертович, к.э.н.

*Редакционный совет:*

Абидова Гулмира Шухратовна, д.т.н.  
Авазов Сардоржон Эркин угли, д. с.-х.н.  
Агафонов Юрий Алексеевич, д.м.н.  
Алейникова Елена Владимировна, д. гос. упр.  
Алиев Закир Гусейн оглы, д. фил. агр.н.  
Бабаян Анжела Владиславовна, д.пед.н.  
Баишева Зия Вагизовна, д.фил.н.  
Байгузина Люза Закиевна, к.э.н.  
Булатова Айсылу Ильдаровна, к.соц.н.  
Бурак Леонид Чеславович, к.т.н.  
Ванесян Ашот Саркисович, д.м.н.  
Васильев Федор Петрович, д.ю.н., член РАЮН  
Вельчинская Елена Васильевна, д.фарм.н.  
Виневская Анна Вячеславовна, к.п.н.  
Габрусь Андрей Александрович, к.э.н.  
Галимова Гузалия Абкадировна, к.э.н.  
Гетманская Елена Валентиновна, д.п.н.  
Гимранова Гузель Хамидулловна, к.э.н.  
Григорьев Михаил Федосеевич, к.сх.н.  
Грузинская Екатерина Игоревна, к.ю.н.  
Гулиев Игбал Адилевич, к.э.н.  
Датий Алексей Васильевич, д.м.н.  
Долгов Дмитрий Иванович, к.э.н.  
Дусматов Абдурахим Дусматович, к.т.н.  
Ежкова Нина Сергеевна, д.п.н.  
Екшикеев Тагер Кадырович, к.э.н.  
Епхиева Марина Константиновна, к.п.н.  
Ефременко Евгений Сергеевич, к.м.н.  
Закиров Мунавир Закиевич, к.т.н.  
Зарипов Хусан Баходирович, PhD  
Иванова Нионила Ивановна, д.сх.н.  
Калужина Светлана Анатольевна, д.х.н.  
Касимова Дилара Фаритовна, к.э.н.  
Киракосян Сусана Арсеновна, к.ю.н.  
Киркимбаева Жумагуль Слямбековна, д.вет.н.  
Кленина Елена Анатольевна, к.ф.н.  
Козлов Юрий Павлович, д.б.н., засл. эколог РФ  
Куликова Татьяна Ивановна, к.псих.н.  
Курбанаева Лилия Хамматовна, к.э.н.  
Курманова Лилия Рашидовна, д.э.н.  
Ларионов Максим Викторович, д.б.н.  
Кондрашихин Андрей Борисович, д.э.н.  
Конопацкова Ольга Михайловна, д.м.н.  
Мальшикина Елена Владимировна, к.и.н.  
Маркова Надежда Григорьевна, д.п.н.  
Мещерякова Алла Брониславовна, к.э.н.  
Мухаммадеева Зинфира Фанисовна, к.с.н.  
Мухамедова Гулчехра Рихсибаевна, к.п.н.  
Набиев Тухтамурод Сахобович, д.т.н.  
Нурдавятова Эльвира Фанизовна, к.э.н.  
Песков Аркадий Евгеньевич, к.полит.н.  
Половения Сергей Иванович, к.т.н.  
Пономарева Лариса Николаевна, к.э.н.  
Почивалов Александр Владимирович, д.м.н.  
Прошин Иван Александрович, д.т.н.  
Саттарова Рано Кадыровна, к.б.н.  
Сафина Зия Закировна, к.э.н.  
Симонович Надежда Николаевна, к.псих.н.  
Симонович Николай Евгеньевич, д.псих.н., академик РАЕН  
Сирик Марина Сергеевна, к.ю.н.  
Смирнов Павел Геннадьевич, к.п.н.  
Старцев Андрей Васильевич, д.т.н.  
Танаева Замфира Рафисовна, д.пед.н.  
Терзиев Венелин Кръстев, д.э.н., д.воен.н., член-корр. РАЕ  
Умаров Бехзод Тургунпулатович, д.т.н.  
Хайров Расим Золимхон угли, д.фил.пед.н.  
Хамзаев Иномжон Хамзаевич, к.т.н.  
Хасанов Сайдинаби Сайдивалиевич, д.сх.н.  
Чернышев Андрей Валентинович, д.э.н.  
Чиладзе Георгий Бидзинович, д.э.н., д.ю.н., член-корр. РАЕ  
Шилкина Елена Леонидовна, д.с.н.  
Шкирмонтов Александр Прокопьевич, д.т.н., член-корр. РАЕ  
Шляхов Станислав Михайлович, д.ф.-м.н.  
Шошин Сергей Владимирович, к.ю.н.  
Юсупов Рахимьян Галимьянович, д.и.н.  
Яковишина Татьяна Федоровна, д.т.н.  
Янгиров Азат Вазирович, д.э.н.  
Яруллин Рауль Рафаэлович, д.э.н., член-корр. РАЕ

---

**СОДЕРЖАНИЕ****ГЕОЛОГО-МИНЕРАЛОГИЧЕСКИЕ НАУКИ**

- Nam N. H., Dung N. H., Ngoc T. T.** 9  
THE EFFECTIVENESS OF UPFLOW SLUDGE BLANKET FILTRATION – USBF TECHNOLOGY FOR TO  
LICH RIVER WATER TREATMENT IN HANOI, VIETNAM

**ТЕХНИЧЕСКИЕ НАУКИ**

- Аллагулыев М., Атаев О., Дадеков Д.** 25  
СОВРЕМЕННОЕ ПРОИЗВОДСТВО ВОДОРОДНОЙ ЭНЕРГИИ
- Атаева А.С., Асгаров Дж. Х.** 28  
ПОНЯТИЕ ЭКОНОМИКИ СТРОИТЕЛЬСТВА И ВАЖНОСТЬ ЕЕ ИЗУЧЕНИЯ
- Атаева А.С., Пенаев Д.П.** 31  
ЭКОНОМИКА СТРОИТЕЛЬСТВА И ЕГО РОЛЬ В НАЦИОНАЛЬНОМ РАЗВИТИИ
- Гаипназарова А., Аннагулыева Б.** 34  
ПРОИЗВОДСТВО: ОПРЕДЕЛЕНИЕ, ТИПЫ, ПРИМЕРЫ И ИСПОЛЬЗОВАНИЕ В КАЧЕСТВЕ  
ИНДИКАТОРА
- Ерков С.С., Агапкин А.М.** 37  
ФИНИКИ: ПИЩЕВАЯ ЦЕННОСТЬ, ПРОИЗВОДСТВО, ОЦЕНКА КАЧЕСТВА, ХРАНЕНИЕ
- Звездилин П.Е., Агапкин А.М.** 44  
МАНГО: ПИЩЕВАЯ ЦЕННОСТЬ, ПРОИЗВОДСТВО, ОЦЕНКА КАЧЕСТВА, ХРАНЕНИЕ
- Комеков К., Гурбанмырадов Б., Дадаев Г., Сахедова А.** 49  
СОВРЕМЕННАЯ ЗАЩИТА ИНФОРМАЦИИ И ОСНОВЫ КИБЕРБЕЗОПАСНОСТИ
- Кулуев Ж.О., Туратбек к. Б., Курманбек у. Ж.** 52  
АНАЛИЗ ВОЗОБНОВЛЯЕМЫХ ИСТОЧНИКОВ ЭНЕРГИИ В КЫРГЫЗСТАНЕ
- Кулуев Ж.О., Туратбек к. Б., Карыбек у. А.** 60  
АНАЛИЗ КОМБИНИРОВАННОЙ СИСТЕМЫ АВТОНОМНОГО ЭЛЕКТРОСНАБЖЕНИЯ
- Маштаков П.П., Агапкин А.М.** 66  
К ВОПРОСУ О ПИЩЕВОЙ ЦЕННОСТИ, ПРОИЗВОДСТВЕ И ИСПОЛЬЗОВАНИЮ МЯСА  
КОНИНЫ И ОЛЕНИНЫ
- Шиманов Ф.К., Агапкин А.М.** 70  
ВОСТОЧНЫЕ СЛАДОСТИ: ОСОБЕННОСТИ РЕЦЕПТУРЫ, КЛАССИФИКАЦИЯ, ПРАВИЛА  
ХРАНЕНИЯ, ДЕФЕКТЫ
- Юсупова Л., Чошиева А., Сарыджаев Ы.** 75  
СОВРЕМЕННОЕ ПРОИЗВОДСТВО ЭЛЕКТРОЭНЕРГИИ

---

**СЕЛЬСКОХОЗЯЙСТВЕННЫЕ НАУКИ**

<b>Актуганов Д.Е., Михайлов Г.Г.</b>	79
ИЗМЕНЕНИЯ В СТРУКТУРЕ ЗЕМЕЛЬНОГО ФОНДА В РОССИЙСКОЙ ФЕДЕРАЦИИ	
<b>Косенко Т.Г.</b>	83
ОСОБЕННОСТИ МЕХАНИЗАЦИИ ПРОИЗВОДСТВА	
<b>Косенко Т.Г.</b>	86
ОЦЕНКА ОТРАСЛЕВОГО ПРОИЗВОДСТВА	
<b>Мищенко М.А.</b>	89
ИСПОЛЬЗОВАНИЕ СОВРЕМЕННЫХ КОМПЬЮТЕРНЫХ ТЕХНОЛОГИЙ ДЛЯ ЦЕЛЕЙ ГОСУДАРСТВЕННОГО КАДАСТРА НЕДВИЖИМОСТИ	
<b>Неуступов Р.О., Минеев Н.А.</b>	92
ГОСУДАРСТВЕННЫЙ ЗЕМЕЛЬНЫЙ НАДЗОР В СИСТЕМЕ УПРАВЛЕНИЯ ОБЪЕКТАМИ НЕДВИЖИМОСТИ	
<b>Ризаев Д.А.</b>	96
СОВРЕМЕННЫЕ ТЕНДЕНЦИИ РАЗВИТИЯ СЕЛЬСКОХОЗЯЙСТВЕННОГО МАШИНОСТРОЕНИЯ	

**ИСТОРИЧЕСКИЕ НАУКИ**

<b>Самофалов К.А.</b>	100
ПОСТЮГОСЛАВСКОЕ ПРОСТРАНСТВО: ПРОБЛЕМЫ, ВЫЗОВЫ	

**ЭКОНОМИЧЕСКИЕ НАУКИ**

<b>Бегжанов Б.Н.</b>	106
ОСОБЕННОСТИ ОРГАНИЗАЦИИ БУХГАЛТЕРСКОГО УЧЕТА ФЕРМЕРСКИХ ХОЗЯЙСТВАХ	
<b>Демченко Д.И.</b>	109
СПЕЦИФИКА УЧЕТА РАСХОДОВ В ТОРГОВОЙ ОРГАНИЗАЦИИ	
<b>Ермакова М.А.</b>	112
НАДБАВКИ И ДОПЛАТЫ В СВЯЗИ С ОСОБЫМИ УСЛОВИЯМИ ТРУДА И С УСЛОВИЯМИ, ОТКЛОНЯЮЩИМИСЯ ОТ НОРМАЛЬНЫХ	
<b>Карпов С.В.</b>	116
ИСПОЛЬЗОВАНИЕ ФЕНОМЕНОВ ПОВЕДЕНЧЕСКИХ ФИНАНСОВ ДЛЯ ПРЕДУПРЕЖДЕНИЯ БАНКРОТСТВА ОРГАНИЗАЦИЙ	
<b>Петухов В.А.</b>	125
ФОРМУЛА НАЛОГОВОГО МУЛЬТИПЛИКАТОРА ДОЛЖНА БЫТЬ ПЕРЕСМОТРЕНА	
<b>Рожков Е.В.</b>	132
ОЦЕНКА ЦИФРОВИЗАЦИИ	

<b>Рожков Е.В.</b> ЗАКОННОСТЬ ПРОХОДЯЩЕЙ НАЦИОНАЛИЗАЦИИ В ЕВРОПЕ	136
<b>Рожков Е.В.</b> АРЕНДАТОРЫ МУНИЦИПАЛЬНОЙ ЗЕМЛИ VS ГОРОДСКОЙ АДМИНИСТРАЦИИ (НА ПРИМЕРЕ ПЕРМИ)	141
<b>Ситдикова И.Р.</b> ИСПОЛЬЗОВАНИЕ ФЕНОМЕНОВ ПОВЕДЕНЧЕСКИХ ФИНАНСОВ ПРИ АУДИТЕ КРЕДИТОВ И ЗАЙМОВ	146
<b>Хунафина В.И.</b> ФОНДОВЫЙ РЫНОК: РОЛЬ И ЗНАЧЕНИЕ, ПРИЗНАКИ И УЧАСТНИКИ	154
<b>Чанышева А.М.</b> ЛОГИСТИКА КАК ФАКТОР ПОВЫШЕНИЯ КОНКУРЕНТОСПОСОБНОСТИ	158
<b>Шагимуратова Э.Р.</b> ОЦЕНКА ФИНАНСОВЫХ РИСКОВ ПРИ ПРИНЯТИИ КРЕДИТНЫХ ЗАЯВОК В БАНКАХ И ЗАВИСИМОСТЬ ЕЕ КАЧЕСТВА ОТ ЛИЧНЫХ ПРЕДПОЧТЕНИЙ КРЕДИТНЫХ СПЕЦИАЛИСТОВ	163

#### ФИЛОЛОГИЧЕСКИЕ НАУКИ

<b>Адилова Д.К.</b> СЕМАНТИЧЕСКОЕ ПОЛЕ ЛЕКСИЧЕСКОЙ ЕДИНИЦЫ «ЖЕНЩИНА»	170
<b>Амиркулова Н.Т.</b> СЛОЖНЫЕ СЛОВА В СОСТАВЕ ФРАЗЕОЛОГИИ	173
<b>Боровская А.А., Бычков Д.М.</b> ХУДОЖЕСТВЕННОЕ СВОЕОБРАЗИЕ ИСТОРИЧЕСКОЙ ПОВЕСТИ С. НУРТАЗИНА «КАЗАЧЬЯ ДОЛЯ»	176
<b>Даниева М.Дж.</b> ЯЗЫК ВЫПОЛНЯЕТ КОММУНИКАТИВНУЮ ФУНКЦИЮ	181
<b>Нургалиева К. М.</b> "A ROOM OF ONE'S OWN" BY VIRGINIA WOOLF: SPATIAL METAPHOR IN HISTORICAL, CULTURAL AND GENDER READING	185
<b>Тайжанова Д.Р.</b> FEATURES OF ENGLISH-SCOTTISH FOLK BALLADS IN FICTION (IN THE WORKS OF WILLIAM WORDSWORTH, WALTER SCOTT, SAMUEL TAYLOR COLERIDGE)	192

#### ЮРИДИЧЕСКИЕ НАУКИ

<b>Anishchenko E.S.</b> FEATURES OF THE TACTICS OF INTERROGATION OF WOMEN	201
--	-----

<b>Baysarin M.N.</b>	207
THE FORMATION OF DOMESTIC CRIMINAL LEGISLATION IN THE FIELD OF CONTROL OF THE TURNOVER OF PSYCHOTROPIC SUBSTANCES FROM ANCIENT TIMES TO THE REFORMS OF PETER I.	
<b>Аникина Ю.П.</b>	213
ДИСКУССИОННЫЕ ВОПРОСЫ НЕОБХОДИМОЙ ОБОРОНЫ (ПО МАТЕРИАЛАМ СУДЕБНОЙ ПРАКТИКИ)	
<b>Афанасьева С.М.</b>	223
К ВОПРОСУ О ДЕЯТЕЛЬНОСТИ МИКРОФИНАНСОВЫХ ОРГАНИЗАЦИЙ И МЕРАХ БОРЬБЫ ПРОТИВ «СЕРЫХ» КРЕДИТОРОВ	
<b>Брель О.С.</b>	230
АДМИНИСТРАТИВНО-ПРАВОВОЙ СТАТУС ГОСУДАРСТВЕННЫХ СЛУЖАЩИХ	
<b>Голуб С.Г.</b>	235
НЕКОТОРЫЕ ПРОБЛЕМЫ ОПРЕДЕЛЕНИЯ КРУГА ЛИЦ, ОБЛАДАЮЩИХ ПРАВОМ СВИДЕТЕЛЬСКОГО ИММУНИТЕТА В УГОЛОВНОМ ПРОЦЕССЕ	
<b>Дудоров В.Е., Шеина В.В., Лигновская Е.В.</b>	241
ПСИХОЛОГИЧЕСКИЕ АСПЕКТЫ БЕЗОПАСНОСТИ ТРУДА	
<b>Кривова П.Д.</b>	245
ПРАВОВЫЕ И ТАКТИЧЕСКИЕ ОСОБЕННОСТИ ПРОИЗВОДСТВА НЕОТЛОЖНЫХ СЛЕДСТВЕННЫХ ДЕЙСТВИЙ	
<b>Семенова А.О., Мурманцева И.Д.</b>	249
ПРОБЛЕМЫ ПРИМЕНЕНИЯ ПОЛИГРАФА В КРИМИНАЛИСТИКЕ	
<b>ПЕДАГОГИЧЕСКИЕ НАУКИ</b>	
<b>Вагабова Т.А.</b>	255
СОВРЕМЕННАЯ ОБРАЗОВАТЕЛЬНАЯ КОНЦЕПЦИЯ И РАЗРАБОТКА ИННОВАЦИОННЫХ УРОКОВ ДЛЯ ФОРМИРОВАНИЯ ТВОРЧЕСКОГО МЫШЛЕНИЯ	
<b>Джумаева Дж., Джумаев М., Халмырадова С.</b>	264
ЭЛЕКТРОННАЯ СРЕДА ДИСТАНЦИОННОГО ОБУЧЕНИЯ ИНОСТРАННЫХ ЯЗЫКОВ	
<b>Дониева З.Ж.</b>	267
РАЗВИТИЕ ДОШКОЛЬНЫХ ОБРАЗОВАТЕЛЬНЫХ ОРГАНИЗАЦИЙ	
<b>Зиёдуллаева С.Ш.</b>	270
ОСОБЕННОСТИ ФОРМИРОВАНИЯ ЛИДЕРСКИХ КАЧЕСТВ У МЛАДШИХ ШКОЛЬНИКОВ	
<b>Комкова Е.Ю., Кириллова О.В.</b>	273
ФОРМИРОВАНИЕ КОММУНИКАТИВНОЙ КОМПЕТЕНТНОСТИ У ДЕТЕЙ С НАРУШЕНИЯМИ РЕЧИ В УСЛОВИЯХ ДОУ	

**Мамедова И.О.** 278  
MODERN EDUCATIONAL CONCEPT AND DEVELOPMENT OF INNOVATIVE LESSONS FOR THE  
FORMATION OF CREATIVE THINKING

**Халаимова Ю.В.** 286  
ПРОЕКТНО-ИССЛЕДОВАТЕЛЬСКИЕ МЕРОПРИЯТИЯ НА УРОКАХ БИОЛОГИИ И ВО  
ВНЕУРОЧНОЕ ВРЕМЯ КАК СРЕДСТВО ПОЗНАВАТЕЛЬНОЙ АКТИВНОСТИ УЧАЩИХСЯ

**Хандурдыева А., Аразаннаева Б., Мамедова Г.** 292  
ЦИФРВЫЕ ТЕХНОЛОГИИ В ОБУЧЕНИИ ОБЩЕСТВЕННЫХ НАУК

**Хемидов Э.А.** 296  
ФОРМИРОВАНИЕ УЧЕБНОЙ САМОСТОЯТЕЛЬНОСТИ ШКОЛЬНИКОВ НА УРОКАХ  
БИОЛОГИИ

**Чориева Ф.Т.** 301  
ЛИНГВОДИДАКТИЧЕСКИЕ КОМПЕТЕНЦИИ И ИХ КАТЕГОРИЗАЦИЯ

#### МЕДИЦИНСКИЕ НАУКИ

**Никитина С.О.** 306  
ОСНОВЫ ЭТИКИ СЕСТРИНСКОГО ДЕЛА. ПСИХОЛОГИЯ ОБЩЕНИЯ МЕДИЦИНСКОЙ СЕСТРЫ  
С ПАЦИЕНТОМ

**Рустамов М.М.** 311  
ПОЛЕЗНОСТЬ И ПРЕИМУЩЕСТВА ПОСТА В РАМАДАН

#### АРХИТЕКТУРА

**Домрачева А.Н.** 315  
ОПТИМИЗАЦИЯ ТЕХНИКО-ЭКОНОМИЧЕСКИХ РЕШЕНИЙ ПО РЕМОНТУ ФУНДАМЕНТА  
БАССЕЙНОВ ГРАДИРНИ

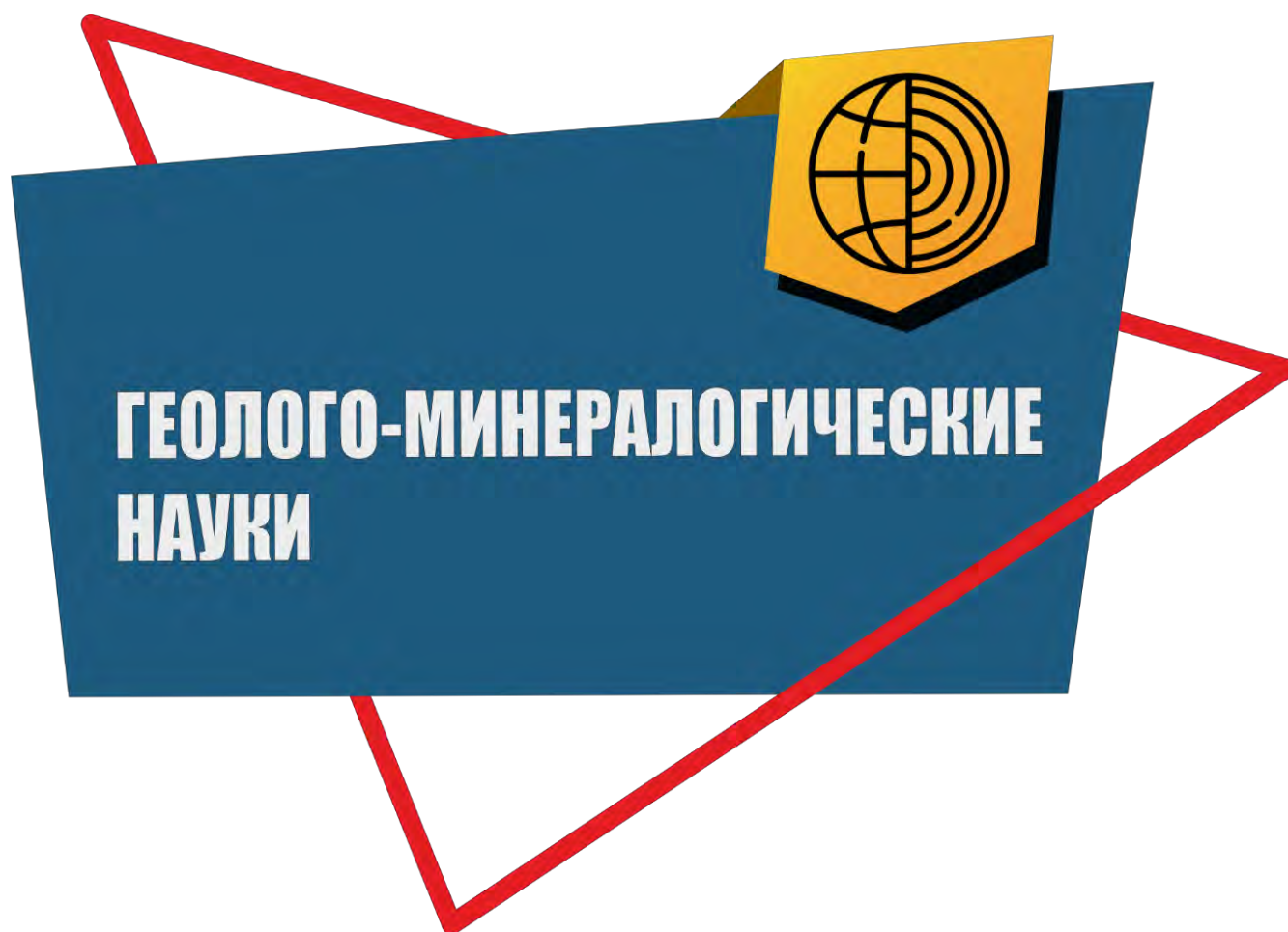
**Ямгулов Д.М.** 321  
ВЫБОР ТИПА ФУНДАМЕНТА ПРИ ВОЗВЕДЕНИИ ЗДАНИЙ ИЗ СБОРНО-МОНОЛИТНЫХ  
КОНСТРУКЦИЙ

#### ПСИХОЛОГИЧЕСКИЕ НАУКИ

**Бутарева Т.С.** 328  
ПРОБЛЕМА НИЗКОЙ УЧЕБНОЙ МОТИВАЦИИ У УЧАЩИХСЯ ПОКОЛЕНИЯ «Z» В ПЕРИОД  
АДАПТАЦИИ УЧАЩИХСЯ К НОВЫМ ПСИХОЛОГО-ПЕДАГОГИЧЕСКИМ УСЛОВИЯМ  
ОБУЧЕНИЯ ПРИ ПЕРЕХОДЕ ИЗ НАЧАЛЬНОЙ ШКОЛЫ В СРЕДНЕЕ ЗВЕНО

#### СОЦИОЛОГИЧЕСКИЕ НАУКИ

**Олейник К.Э.** 333  
ФИЗИЧЕСКОЕ ВОСПИТАНИЕ МОЛОДОЙ СЕМЬИ: ПУТЬ К ЗДОРОВЬЮ И ГАРМОНИИ





**УДК 574****Nguyen Hoang Nam**

Lecturer at University of Mining and Geology,

Hanoi, Vietnam

**Dung Nguyen Hoang**

Master at ACE Construction Environment Co. Limited

**Ngoc Tran Thi**

Lecturer at University of Mining and Geology,

Hanoi, Vietnam

## **THE EFFECTIVENESS OF UPFLOW SLUDGE BLANKET FILTRATION – USBF TECHNOLOGY FOR TO LICH RIVER WATER TREATMENT IN HANOI, VIETNAM**

### **Abstract**

This paper reports the results of applying Upflow Sludge Blanket Filtration - USBF technology to treat Tolich river in Hanoi, Vietnam. The system was operated continuously for 31 days with HRT of 10h, the average MLSS content in the anoxic compartment reached 3794 mg/L, and 2769 mg/L in the aerobic compartment respectively. The microorganisms grew very well and stably, thus this content is relevant for the removal of pollutants in Tolich river. The biological sludge in the aerobic compartment during the treatment process had the highest SVI value of 126 and the lowest value of 49 mg/g. The removal efficiency for TSS was from 90.83 to 98.06%; COD was 88.4 – 96.1%;  $\text{NH}_4^+$ -N was 78.30 – 92.85%;  $\text{PO}_4^{3-}$ -P was 77.09-87.42%. The content of pollutants such as TSS, COD,  $\text{NH}_4^+$ ,  $\text{PO}_4^{3-}$  after treatment by the USBF system was much lower than National technical regulation - QCVN 08:2015 - BTNMT. Generally, the USBF technology is a possible option to apply to treatment of the To Lich river in Hanoi in particular and rivers in other large urban areas in Vietnam in general, in order to bring environmental purity to the community, and other major cities in Vietnam.

---

## Keywords

COD, TSS, amonium, phosphor, treatment, USBF.

### 1. Introduction

To Lich River is a small river, flowing from West Lake, passing through 6 districts of Hanoi and discharged into Nhue River. To Lich River not only creates the landscape of the city, but also carries out waste water to processed plants. Currently, To Lich river water is heavily polluted with complex wastewater components and properties, mainly organic substances, nitrogen compounds, phosphorus compounds, pathogenic bacteria, heavy metals, causing strong odors, black, effervescent water, affecting the landscape, aquatic animals as well as the landscape, environment and people's lives around the To Lich River.

Facing with the fact that the To Lich River has been heavily polluted, for many years, the authorities have struggled to find relevant solutions to revive the Tolich River such as: using SBR (Mello 2019; Aboodi et al. 2017), AAO, Constructed Wetland technologies (Rahman et al. 2020; Omondi and Navalia 2020)... however, each technology has its advantages and disadvantages. And the main disadvantage is that it is not consistent with reality in Hanoi.

The basic activated sludge process combined with an anoxic process and suspended sludge settling in a biological treatment plant has been enhanced by Bio-USBF (Up-flow Sludge Blanket Filtration). It takes up less space and related equipment as a combined system. The USBF technique is based on the upflow sludge blanket clarifier concept. The wastewater travels from the bottom of the settling tank through a specifically constructed partition system where the hydro flocculation process occurs after being disturbed in this compartment, which has a trapezoidal form. The trapezoidal clarifier maintains a constant flow rate from bottom to top of the sump, allowing for a progressive decrease in velocity gradient (Mesdaghinia et al. 2010).

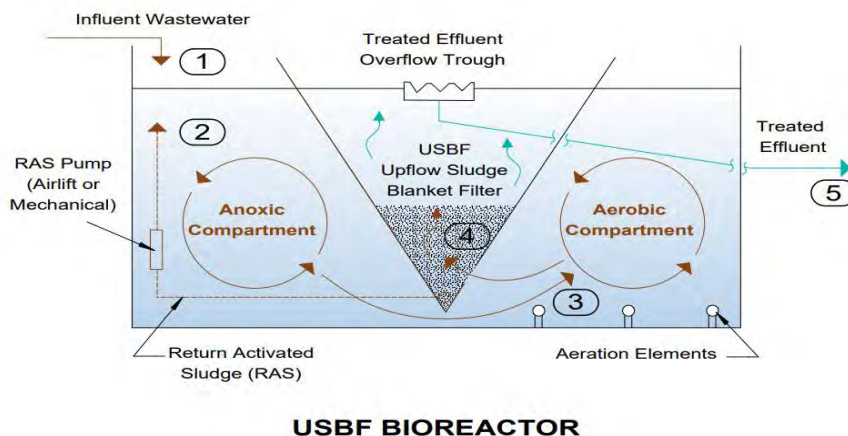


Figure 1 – Diagram of USBF technology (Mesdaghinia et al. 2010)

The tank is designed to remove COD, BOD, and nutrient removal (N and P). All biological treatment and sludge separation processes are provided within the compact integrated biological reactor (IBR). The IBR contains three consecutive biological zones:

- A. denitrification zone or anoxic zone
- B. nitrification zone or aeration zone
- C. anaerobic zone or separation zone

Anaerobic and denitrification zones are mixed by mechanical mixers, in the nitrification zone is a fine-bubble aeration system with very high oxygen transfer efficiency providing the oxygen delivery and mixing. The pressure air for aeration is provided by blowers.

The USBF separator is build-in in nitrification zone and provides the outflow of treated water. The separated sludge from USBF separator together with nitrates from nitrification zone is recirculated into the denitrification zone, and the mixed liquor from the end of denitrification zone is recirculated to the anaerobic zone. The wastewater inflows into anaerobic zone where it meets with activated sludge recirculated from the denitrification zone. The phosphorus accumulating organisms in activated sludge take in anaerobic conditions some substances from wastewater and release some accumulated phosphorus.

The mixed liquor from anaerobic zone then flows into denitrification zone, where facultative aerobic organisms in activated sludge are taking the oxygen from recirculated nitrates for oxidation and consumption of some substances from wastewater. By this process, nitrates are converted to gaseous nitrogen, which is released to air, and it thus reduces the concentration of total nitrogen in water. The mixed liquor from denitrification zone then flows to nitrification zone, where proceeds the oxidation and consumption of remaining organic substances from wastewater and ammonium is oxidized by nitrification bacteria to nitrates, which are then recirculated to denitrification as described above. The phosphorus accumulating organisms there due to proceeding phosphorus release take in presence of oxygen surplus of phosphorus and convert it to deposited polyphosphates, which results in biological dephosphorization.

USBF technology is a technology that has not been widely disseminated in Vietnam, the system is compact in size, easy to install, convenient, with high processing efficiency, suitable for crowded urban areas where there limited area.

## **2. Materials and Methods**

### **2.1. *Cultivation of enrichment cultures of microorganisms***

#### **2.1.1. *Aerobic microbial enrichment culture***

Aerobic microorganisms were obtained from biological sludge in the aerobic biological treatment tank of the wastewater treatment system. The sludge was centrifuged cold at 4°C at 8500 rpm for 15 minutes. After pretreatment, aerobic bacteria were cultured enriched in the following enrichment cultures: Weigh 200 g of dewatered sludge into a 1L DURAN®-Flaschen culture flask (Schott, Mainz), supplemented 800 ml of nutrient solution (according to ATCC medium 1490) was placed in the flask and then mixed with air at a rate of 1 Ln/L/min continuously for 20 days, at room temperature (25-30°C). In the process of microbial enrichment culture, after 2 to 3 days, add nutrient solution by settling the microbial solution for 30 to 60 minutes, decant clear water, add nutrient solution. and continue to inject air into the tank.

### *2.1.2. Anaerobic microbial enrichment culture*

Anaerobic microorganisms were obtained from biological sludge in the anaerobic biological treatment tank of the wastewater treatment system. The sludge was centrifuged cold at 4°C at 8500 rpm for 15 minutes. After pretreatment, bacteria were cultured enriched in the following enrichment cultures: Weigh 200g of dewatered sludge into a 1L DURAN®-Flaschen culture flask (Schott, Mainz), supplemented with 800 ml of nutrient solution (Andreas O. Wagner et al. 2019), aerate N<sub>2</sub> into the flask for 10 minutes to expel all dissolved oxygen in the solution. Then, install a stirrer with an impeller to stir the solution at a constant speed of 50 rpm at room temperature (25-30°C). Nutrient solution is added regularly (2-3 days once). Anaerobic microorganisms were cultured and enriched continuously for 20 days.

### *2.1.3. Microbial adaptive culture in the USBF system*

Before operating the system, the enriched cultured microorganisms are put into the anaerobic and aerobic compartments of the system so that the microorganisms can adapt and grow accordingly as follows:

Aerobic microorganisms after enrichment culture are put into the aerobic compartment, anaerobic microorganisms after enrichment culture are put into the anaerobic compartment of the treatment system, both microorganisms are mixed. Dilute with To Lich river water with the concentration of MLSS about 2500 - 4000 mg/L and continue to culture, acclimatise in anaerobic and aerobic environment of the treatment system with a retention time of 24 hours for 53 consecutive days. During the culture process, measure the increased biomass by determining the MLSS index.

## **2.2. Characteristics of To Lich river water**

To Lich river water used in the study was taken at the area of Hoang Quoc Viet bridge, with the content of some main components as follows: pH: 7.28 - 7.84; COD: 123 - 143.9 mg/L; TSS: 67-113 mg/L; NH<sub>4</sub><sup>+</sup>-N: 10.30 - 29.50 mg/L; N<sub>tot</sub>: 28.72 - 30.51 mg/L; NO<sub>3</sub><sup>-</sup>-N: 3.13 - 3.84 mg/L; PO<sub>4</sub><sup>3-</sup>-P: 2.68 - 5.26 mg/L;

### 2.3. Experimental set up

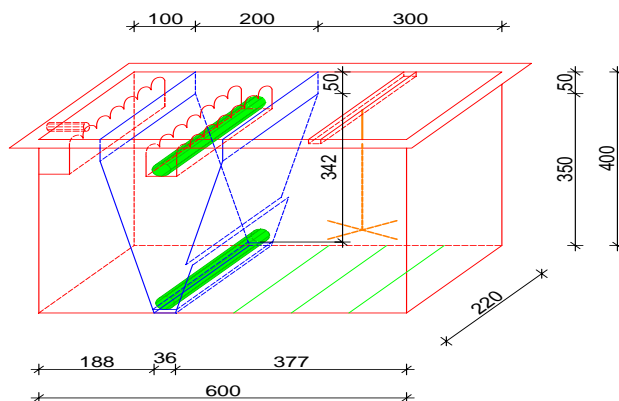


Figure 1 – Scheme of the USBF system

The system is made of stainless steel, with a length of 60 cm, a width of 30 cm and a height of 40 cm with a processing capacity  $Q = 140$  l/d. The inside is designed into 3 compartments including: Anoxic compartment (HRT: 2.2h), aerobic compartment (HRT: 6h) and USBF compartment (HRT: 1.8h). In the anaerobic and aerobic compartments, two stirrers are installed with blades of 8 cm long, and 1.5 cm wide, and they are operated continuously at a speed of 60 rpm to stir evenly throughout the system operation. The aerobic compartment is installed with an aeration system with an air distribution rig that is 3 silicon rods, each 20 cm long, the distance between the bars is 10 cm, fixed at the bottom of the aerobic compartment connected to the air compressor, aims to provide oxygen to aerobic microorganisms at a rate of  $13 \text{ (m}^3/\text{h)}$ .

To Lich river water is continuously pumped into the anaerobic compartment with a flow of  $Q = 5.9$  l/h. Water, after passing through the anaerobic compartment, continues through the aerobic compartment and then into the USBF compartment, then through the serrated trough to collect water on the surface of the compartment, then is taken out by a one-way valve, the wastewater is treated after treatment. is stored in a plastic tank containing the outlet water.

During operation, the amount of sludge in the USBF compartment is automatically brought back to the anoxic chamber by the sludge circulation pump, with a cycle of 2 hours, and the sludge circulation pump once in 15 minutes.

The system was operated continuously for 1 month from October 8, 2021 to November 8, 2022 and are operated with a retention time of 10 hours for the whole system.

#### **2.4. Sampling and Analytical methods**

During the microbial enrichment culture period, samples were taken daily to check the SVI and MLSS contents in the anaerobic and aerobic compartments. During To Lichriver water treatment operations, samples are taken at the input and output of the system to evaluate the treatment efficiency of some key parameters such as: TSS, COD, BOD<sub>5</sub>, total of P and total of N. Samples were taken daily in anaerobic and aerobic compartments at a depth of 20 cm to determine SVI and MLSS indices to assess the level of microbial activity in the system. The samples were analyzed following the standard methods.

### **3. Results and discussion**

After 1 month of operation for domestic wastewater treatment, the USBF system continued to be used for research and evaluation of the effectiveness of To Lich river water treatment. The system is operated continuously for 31 days and has the HRT of 10 h. The results of studying the efficiency of To Lichriver water treatment by the USBF system are shown in Figures 3 to 8.

The obtained results show that, during the operation of the system with To Lichriver water, the MLSS content in the anoxic and aerotic compartments is quite stable despite the change in inlet wastewater characteristics (See Fig. 3) .

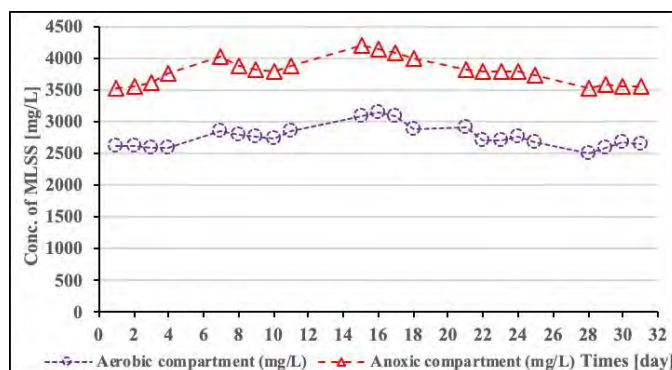


Figure 3 – The MLSS content during To Lichriver water treatment in USBF

The values of MLSS in the anoxic compartment ranged from 3530 to 4191 mg/L (mean 3794 mg/L), and in the aerotic compartment between 2514 and 3147 mg/L (mean 2769 mg/L). It shows that microorganisms in both compartments grow very well and stably and with this content, it is quite suitable for removing pollutants in wastewater. (Toledo-Cervantes et al. 2019).

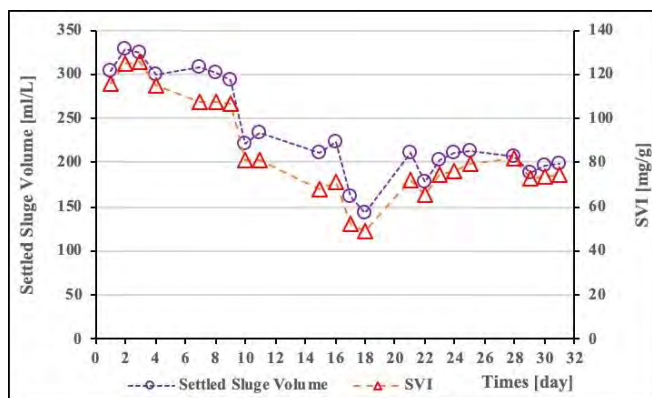


Figure 4 – The SVI change in the aerobic compartment of the USBF system during To Lich river water treatment.

Meanwhile, the SVI index in the aerobic bioreactor of the USBF system tended to decrease from day 2 to day 18, then tended to stabilize after day 21 (See Fig. 4). During the To Lichriver water treatment process, the highest SVI value was 126 and the lowest was 49, which proves that the biological sludge in the aerobic compartment during the To Lichriver water operation has good settling properties. (Cleary and Eckenfelder 2013; Boutchich et al. 2015). This positively affects the removal of suspended solids in the USBF compartment. Although the observed input TSS value fluctuates quite a bit, the output TSS value is quite stable. The TSS value after leaving the system decreased from 67-112 mg/L to 1.3 - 10.6 mg/L (average at the outlet was only 7.17 mg/L), corresponding to the removal efficiency from 90.83 to 90.83 mg/L. 98.06% (See Fig. 5). The observed high TSS removal efficiency of the system for To Lichriver water could be attributed to the low TSS content in the To Lichriver water and the low SVI of the activated sludge. In the USBF system, the high TSS removal efficiency can be attributed to the adsorption of suspended



substances on the bioflocs, on the other hand, the aerobic compartment of the system has a relatively low SVI, so the the suspended solids settling process went very well (Boutchich et al. 2015). In addition, the decomposition of organic compounds by aerobic microorganisms as well as heterotrophic denitrifying bacteria contributes significantly to the decomposition of organic compounds in particular and suspended solids in general (Bothe et al. 2006).

The obtained results show that the USBF system has a high TSS removal efficiency, quite similar to other studies (Salama et al. 2020) and the TSS content after passing through the system is much lower than with QCVN 08/2015 BTNMT.

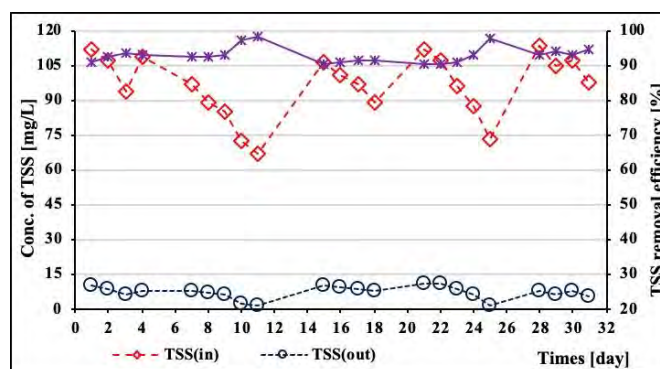


Figure 5 – The TSS removal efficiency of USBF system  
in To Lichriver water treatment process

For COD because during operation of To Lich river water treatment, its content is observed at low inlet, its value fluctuates in the range of 120-143 mg/L, after passing through the system, the value Its value was reduced to about 4.8-16.6 mg/L (mean 8.1 mg/L), removal efficiency was 88.4 - 96.1% (mean 93.92%) (See fig. 6).

In To Lich river water, the low COD content is partly due to dilution, partly because the biodegradable organic compounds have been partially removed during the migration process, the remaining organic compounds remain. However, thanks to anaerobic and aerobic biological processes as well as upstream filtration of the USBF compartment and low SVI, COD is removed with quite high efficiency (Wang et al. 2014).

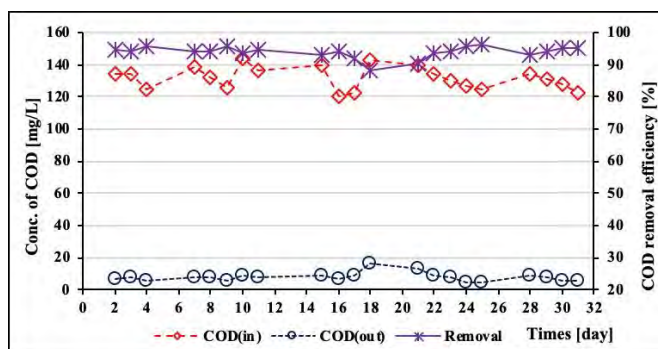


Figure 6 – The COD removal efficiency of USBF system in To Lichriver water treatment

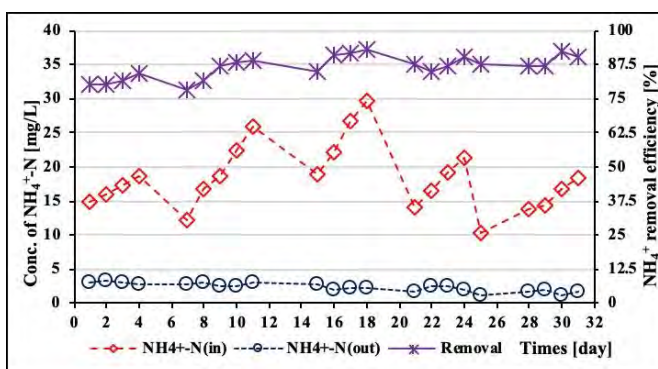


Figure 7 –  $\text{NH}_4^+$  removal efficiency of USBF system in To Lichriver water treatment

As for the  $\text{NH}_4^+$  indicator, the  $\text{NH}_4^+\text{-N}$  content at the inlet of To Lich river water is low, its value is in the range of 10.25 - 29.55 mg/L and it fluctuates quite strongly, however, after going through the content system,  $\text{NH}_4^+\text{-N}$  decreased to 1.27 – 3.19 mg/L and relatively stable was observed. The treatment efficiency for  $\text{NH}_4^+\text{-N}$  of the system was 78.30 – 92.85% (average 86.54%) (See fig. 7).

The obtained results show that, during the operation of the USBF system to treat To Lich river water, although the input  $\text{NH}_4^+\text{-N}$  content is low, the  $\text{NH}_4^+$  removal efficiency in To Lich river water is not high. The reason may be that when the  $\text{NH}_4^+$  content is low, it is more difficult to remove  $\text{NH}_4^+$ . However, the output water has low  $\text{NH}_4^+\text{-N}$  content if compared with other biological systems, the  $\text{NH}_4^+$  removal efficiency in the USBF system is higher and the output  $\text{NH}_4^+$  content is more stable (Waqas et al. 2020).

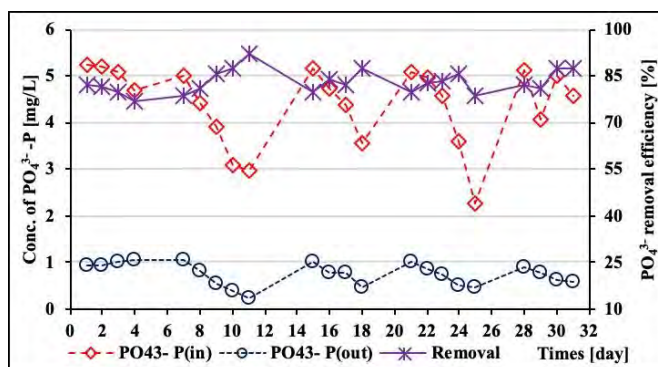


Figure 8 – The  $\text{PO}_4^{3-}$  removal efficiency of USBF system in To Lichriver water treatment

For Phosphor removal, during the operation of the To Lich river water treatment system, the  $\text{PO}_4^{3-}$ -P concentration was observed at the inlet low, its value in the range 2.26-5.26 mg/L (average 4.39). mg/L), after passing through the USBF system its value decreased to about 0.24-1.07 mg/L (mean 0.75 mg/L), corresponding to a removal efficiency of 77.09-87.42% (mean). 83.05% (See fig. 8). The reason may be due to the load of organic compounds, the input nitrogen and phosphorus content in To Lich river water is lower than that of domestic wastewater. Dissolved organic compounds are fermented at Aerobic and Anoxic compartments in To Lichriver water to create products that create a special composition of microorganisms, making them have a lower phosphorus storage capacity, thus their removal efficiency is lower (Bunce et al. 2018; Khorsandi et al. 2011). However, the content of P in the output water is lower than National technical regulation - QCVN 08/2015 BTNMT.

#### 4. Conclusions

Since To Lich river water is the main reservoir of domestic wastewater from surrounding households, it has similar characteristics to domestic wastewater but with lower concentrations of pollutants. A number of pollution indicators present in To Lichriver water after being treated with the USBF system is significantly reduced, specifically: The SVI index is also lower than in the domestic wastewater treatment process, thereby helping the process Better suspended solids settling; TSS content is 1.3 – 10.6 mg/L (average output is only 7.17 mg/L); COD remains 4.8-16.6 mg/L (average is

8.1 mg/L);  $\text{NH}_4^+\text{-N}$  to 1.27 – 3.19 mg/L and  $\text{PO}_4^{3-}\text{-P}$  to 0.24-1.07 mg/L (mean 0.75 mg/L). Experimental results show that using the USBF system to treat To Lich river water can meet the criteria of surface water according to the allowed standards of Vietnam, it is an appropriate choice both economically and technology to treat To Lich river water, contributing to reducing environmental pollution in Hanoi city, preserving the urban landscape of Hanoi.

### ***Acknowledgment***

The authors would like to sincerely thank the Institute of Biotechnology - Institute of Environmental Technology, Vietnam Academy of Sciences; Center for Environmental Treatment - Military Institute of Science and Technology; Department of Chemistry – Faculty of Basic Sciences – University of Mining - Geology has facilitated and support in the research process.

### ***Authors' contributions***

Nam Nguyen Hoang: makes an important contribution in proposing ideas and designing research; checks data; data processing; examines the knowledge content of the article; the ratification of the final draft before submitting it to the scientific journal. Ngoc Tran Thi: makes an important contribution in proposing ideas and designing research; checks data; data processing; seriously examines the knowledge content of the article; the ratification of the final draft before submitting it to the scientific journal. Dung Nguyen Hoang: makes contribution in experiment implementation, data collection, data analysis and translation; has contributed to the drafting of the article.

### **References**

1. Aboodi, Ali Hassan Al, Husham Ibrahim, and Sarmad Abdullah Abbas. 2017. 'Performance of sequencing batch reactor (sbr) for domestic wastewater treatment under low temperature in basrah city (south of iraq)', International Journal of Civil Engineering and Technology (IJCET), 8: 787-96.
2. Boutchich, G. El Kadiri, S. Tahiri, M. Mahi, D. Gallart-Mateu, M. de la Guardia, A.

- Aarfane, E.Lhadi, and M. El Krati. 2015. 'Characterization of activated sludge from domestic sewage treatment plants and their management using composting and co-composting in aerobic silos, 6(8) (2015) 2206-2220.', J. Mater. Environ. Sci., 6: 2206-203.
3. Bunce, Joshua T., Edmond Ndam, Irina D. Ofiteru, Andrew Moore, and David W. Graham. 2018. 'A Review of Phosphorus Removal Technologies and Their Applicability to Small-Scale Domestic Wastewater Treatment Systems', Front. Environ. Sci.
4. Cleary, Joseph G., and W. Wesley Eckenfelder. 2013. *Activated Sludge Technologies for Treating Industrial Wastewaters: Design and Troubleshooting* (Destech Publications Incorporated).
5. Gu, Shengbo, Lebin Liu, Xiaojie Zhuang, Jinsheng Qiu, and Zhi Zhou. 2022. 'Enhanced Nitrogen Removal in a Pilot-Scale Anoxic/Aerobic (A/O) Process Coupling PE Carrier and Nitrifying Bacteria PE Carrier: Performance and Microbial Shift', Sustainability, 14.
6. Khan, M. B., H. Nisar, C. A. Ng, and P. K. Lo. 2016. "Estimation of sludge volume index (SVI) using bright field activated sludge images." In *IEEE International Instrumentation and Measurement Technology*
7. Khorsandi, Hassan, Hossein Movahedian Attar, Bijan Bina, and Hossein Farrokhzadeh. 2011. 'Innovative anaerobic/upflow sludge blanket filtration bioreactor for phosphorus removal from wastewater', Environmental Technology, 32: 499–506.
8. Krishnaswamy, Usharani, Muthukumar Muthusamy, and Lakshmanaperumalsamy Perumalsamy. 2009. 'Studies on the Efficiency of the Removal of Phosphate Using Bacterial Consortium for the Biotreatment of Phosphate Wastewater', European Journal of Applied Sciences 1, 1: 6-15.
9. Leal, Cristiano, Angeles Val del Río, Daniela P. Mesquita, António L. Amaral, Paula M. L. Castro, and Eugénio C. Ferreira. 2020. 'Sludge volume index and suspended solids estimation of mature aerobic granular sludge by quantitative image analysis and chemometric tools', Separation and Purification Technology, 234.
10. Li, Jun, Xin-Hui Xing, and Bao-Zhen Wang. 2003. 'Characteristics of phosphorus removal from wastewater by biofilm sequencing batch reactor (SBR)', Biochemical Engineering Journal, 16: 279-85.

11. Mello, Lois K. 2019. Sequencing Batch Reactors: An Overview (Nova).
12. Mesdaghinia, A. R., A. H. Mahvi, R. Saeedi, and H. Pishrafti. 2010. 'Upflow Sludge Blanket Filtration (USBF): an Innovative Technology in Activated Sludge Process', Iranian J Publ Health, 39: 7-12.
13. Omondi, Donde Oscar, and Atalitsa Caren Navalía. 2020. Constructed Wetlands in Wastewater Treatment and Challenges of Emerging Resistant Genes Filtration and Reloading (Inland Waters - Dynamics and Ecology ).
14. Rahman, Md Ekhlashur, Mohd Izuan Effendi Bin Halmi, Mohd Yusoff Bin Abd Samad, Md Kamal Uddin, Khairil Mahmud, Mohd Yunus Abd Shukor, Siti Rozaimah Sheikh Abdullah, and S M Shamsuzzaman. 2020. 'Review: Design, Operation and Optimization of Constructed Wetland for Removal of Pollutant', International Journal of Environmental Research and Public Health, 17: 8339 -79.
15. Salama, Y., O. Salama, M. Chennaoui, and M. Mountadar. 2020. 'Study of dysfunction into activated sludge basins in sewage treatment plant of the City of Khouribga (Morocco)', J. Mater. Environ. Sci., 11: 922-42.
16. Shao, Yanxi, Yijing Shi, Abdul Mohammed, and Yang Liu. 2017. 'Wastewater ammonia removal using an integrated fixed-film activated sludge-sequencing batch biofilm reactor (IFAS-SBR): Comparison of suspended flocs and attached biofilm', International Biodeterioration & Biodegradation, 116: 38-47.
17. Toledo-Cervantes, Alma, Esther Posadas, Isabel Bertol, Sara Turiel, Ana Alcoceba, and Raúl Muñoz. 2019. 'Assessing the influence of the hydraulic retention time and carbon/nitrogen ratio on urban wastewater treatment in a new anoxic-aerobic algal-bacterial photobioreactor configuration', Algal Research, 44.
18. Trapani, Daniele Di, Magnus Christensson, Michele Torregrossa, Gaspare Viviani, and Hallvard Ødegaard. 2013. 'Performance of a hybrid activated sludge/biofilm process for wastewater treatment in a cold climate region: Influence of operating conditions', Biochemical Engineering Journal, 77: 214-19.
19. Wagner AO, Markt R, Mutschlechner M, Lackner N, Prem EM, Praeg N, Illmer P. 2019. 'Medium Preparation for the Cultivation of Microorganisms under Strictly Anaerobic/Anoxic Conditions.', J. Vis Exp. 2019 Aug 15;(150):10.3791/60155. doi:

10.3791/60155.'

20. Wang, G., Z. Fan, D. Wu, L. Qin, G. Zhang, C. Gao, and Q. Meng. 2014. 'Anoxic/aerobic granular active carbon assisted MBR integrated with nanofiltration and reverse osmosis for advanced treatment of municipal landfill leachate', *Desalination*, 349: 136–44.
21. Wang, Yao, Baorui Liang, Fei Kang, Youzhao Wang, Chaoyue Zhao, Zhenning Lyu, Tong Zhu, and Zhijun Zhan. 2022. 'An efficient anoxic/aerobic/aerobic/anoxic process for domestic sewage treatment: From feasibility to application', *Front Microbiol.*, 13.
22. Waqas, Sharjeel, Muhammad Roil Bilad, Zakaria Mana Yusuf Wibisono, Juhana Jaafar, Teuku Meurah Indra Mahlia, Asim Laeeq Khan, and Muhammad Aslam. 2020. 'Recent progress in integrated fixed-film activated sludge process for wastewater treatment: A review', *Journal of Environmental Management*, 268.
23. Zamora, Sergio, J. Luis Marín-Muñiz, Carlos Nakase-Rodríguez, Gregorio Fernández-Lambert, and Luis Sandoval. 2019. 'Wastewater Treatment by Constructed Wetland Eco-Technology: Influence of Mineral and Plastic Materials as Filter Media and Tropical Ornamental Plants', *Water*, 11: 2344-56.

© Nam N. H., Dung N. H., Ngoc T. T., 2023