

## تسجيل محضر اجتماع MEETING MINUTES RECORD

DIVISION/DEPARTMENT/OFFICE/COMMITTEE		الإدارة / الدائرة / المكتب / اللجنة
<b>Commercialization Division</b>		
PURPOSE OF MEETING		موضوع الاجتماع
<b>IP Committee Meeting</b>		
MEETING LOCATION	MEETING DATE	MEETING NO.
مكان الاجتماع	تاريخ الاجتماع	رقم الاجتماع
<b>Zoom Meeting Room</b>	21/06/2021	34
PRESENT		الغائب
<p>الحضور</p> <p>Eng. Eiman Al-Awadhi DD/CD (acting chairman)  Mr. Adnan Akbar, Member  Dr. Ali Hajiah, Member  Dr. Firas Rasoul, Member  Dr. Husam Arman, Member  Dr. Saif Uddin, Member  Dr. Mohammed Salman, Member  Eng. Ahmad Haji, Member  Dr. Mohamed Elmuntasir Ahmed, WRC/Inventor  Ms. Fatma S. Mohammad, STID/CD</p>		<p>ABSENT</p>
مواد للنقاش ITEMS OF DISCUSSION		الإجراء اللازم اتخاذه ACTION TO BE TAKEN
<p>On behalf of Chairman Mr. Abdul Mohsen Al-Haroon, Eng. Eiman Al-Awadhi (acting chairman) welcomed the IP committee members to the 33rd committee meeting.</p> <p><b>Review of ID "Sustainable combined Solar/AnMBR process for wastewater treatment" presented by Dr. Dr. Mohamed Elmuntasir Ahmed</b></p> <p>The invention as presented by M. Elmuntasir Ahmed is a system design and process which integrates an evaporator, an anaerobic membrane biological reactor (AnMBR) and membrane filtration unit, which can be Nano-filtration (NF). The input stream (wastewater, including domestic, industrial, and grey water) is introduced to the evaporator, which is operated by a solar energy source that drives the systems to be able to create a heat transferred from condensing steam to a solution at a lower temperature across a metallic heat transfer surface. The absorbed heat causes vaporization of the solvent, which is collected as a separate stream. The concentrated wastewater is transferred to the second stage, which is the anaerobic biological treatment (MBR). The anaerobic membrane biological reactor (AnMBR) filters the concentrated wastewater stream and treats the organic material in wastewater to</p>		

create products, which are sludge and a stream of water. Within the reactor, the sludge is treated anaerobically by mesophilic bacteria which release methane as a byproduct. The biogas can later be combusted to generate heat or energy. While the reactor will be also connected to a membrane filtration unit that will further treat the other byproduct to pure water (attached in the appendix is the presentation).

**Discussion:**

**Q1:** The technology of AnMBR combined with a membrane filtration does exist, and the modified invention combines the existing technology with a new source of energy (solar evaporator). Wouldn't this method of technology integration be obvious to someone in the field?

**A1:** Yes, it is obvious that using solar energy source will reduce the energy used. In the context of this invention, we are using the solar evaporator for additional purposes including the treatment of wastewater, concentration of wastewater, and the enhancement of production of methane. The proposed flow scheme will also help to prolong membrane life and reduce maintenance requirement.

**Q2:** the disadvantages of AnMBR mentioned in the presentation, are they addressed in the modification of the invention?

**Q2.1:** the membrane fouling is reduced?

**Q2.2:** the process configuration and temperature issues?

**Q2.3:** the sulfate concentration in the sewage? Sewage concentration?

**A2:** the concentration will be lower coming in from the solar still and as such the membrane fouling will be less compared to the traditional AnMBR.

In wastewater, the concentration of sulfate is not typically high. However, the limited sulfate concentration on the membrane can also be resolved with the solar still effluent combination with the effluent from anaerobic reactor.

**Q3:** How the production of methane gas will be stored and reused? Will you be integrating a process with your invention to reuse methane?

**A3:** The methane use is outside the scope of the invention. However, usually the biogas is recovered in a recovery unit, which can be reused to produce

energy in the process itself. The biogas energy conversion is a separate technology used for different biogas produced from different processes including wastewater, anaerobic sludge digesters, and even naturally produced gas/biogas. As such, it is not part of the current technology innovation.

**Q4:** In regard to the data and analysis prepared to proof the invention functionality, are there any tests that have been conducted?

**A4:** The proposal is still under process. We are combining different technologies under a specific configuration. We estimated the improvement of recovery of the methane and the energy and water consumption. We understand the importance of recording actual data to prove that the invention is functional according to the configuration. However, the current process flow scheme and configuration will definitely add to process efficiency and energy positivity.

**Q5:** Wouldn't the project yield a better design for the invention, as it will highlight to you the shortcomings, or it might highlight a new improvement on the design? It might strengthen the patent claims of the invention.

**A5:** There are different organizations that are experimenting with new AnMBRs and improvements in energy usage and recovery of methane, including King Abdullah University. Thus, there are concerns that other organizations might file similar patents and KISR might lose the opportunity.

As explained in the presentation, the invention's design and process will perform better compared to the standard AnMBR, the question is not will it perform better, but rather perform better by how much.

**Q6:** Any modeling was conducted on the process of the solar still, which helped to show the expected performance?

**A6:** There are a number of published papers on the different types of configurations of solar stills and wastewater treatment, which we reviewed to come up with the design. The invention integrates the solar still with the AnMBR with the process flow arrangement of our own configuration. The solar still design is not the focus of the invention as it adds value at any design, however the most suitable to Kuwait conditions will be used.

The proposal will address the optimal configuration of solar still to be used. However, any type is expected to generate improved results.

**Q7:** What is the physical footprint of the process?

**A7:** the usage AnMBR itself has been proven to be a success. For example, the Singapore wastewater treatment relies on AnMBR, which managed to treat the wastewater to a drinkable level. We are improving on this success by using a new integrated system with a more durable method.



**Patent and Market landscape report:**

Fatma Shah presented the report and the following are the highlights:

- There is a positive and increasing trend for the publication of research papers as well as patents in the field of AnMBR with membrane filtration, as well as the adoption of alternative energy source (peaked in 2016).
- Prior art did not identify similar patents.
- There are several patent holders who have similar equipment for gas sensors, especially in Germany, China, US, Japan and South Korea.
- The patent holders (companies) are also the manufactures of wastewater treatment technologies.
- Technology readiness level (TRL) seems to be currently on level 2 (the technology concept formulation level). The TRL is expected to increase to level 5 (validation level) once the project is completed.
- The market size of MBR is estimated to be USD 3.0 billion in 2019 and is projected to reach USD 4.2 billion by 2024, at a CAGR of 7.0%.
- The main market players are testing labs located in the US, EU, China and Japan.
- The report concluded that due to positive trend of filing for similar inventions, the high cost of prototype (70,000KD), and the potential of funding from international sources, it is recommended to protect the IP as soon as possible.

**IP Committee's Comments:**

The committee discussed following protection options:

<p>1. <b>Filing a non-provisional patent application:</b> dismissed as the invention is not mature enough.</p> <p>2. <b>Postponing the filing of a non-provisional patent application, until more data is available:</b> it is always preferred to file patent applications with prototype and results that prove that the invention is functional and yields better results than other inventions.</p> <p>However, as KISR will be engaging with funding organizations outside of Kuwait, the committee prefers a temporary protection.</p> <p>3. <b>Filing a provisional patent application, while the inventor works on the prototype</b> (one year): for negotiation with the funding parties. Once fund is committed, or more data is available, KISR will file a non-provisional patent application to keep the protection over the invention.</p> <p>4. <b>Know-how protection:</b> The committee noted that the aspect of integrating a solar still with the AnMBR seems to be obvious. Thus, the final design of the prototype and the process might clarify the differences between his invention and other inventions that use solar energy.</p> <p><b>IP Committee Recommendation</b></p> <p>The committee members all agreed on the third option to file a provisional patent application while ensuring any knowhow generated during the design phase is kept confidential.</p>	<p>Fatima Shah will follow-up with the inventor on the progress of the project.</p> <p>STID/CD will prepare a provisional patent application.</p>
DISTRIBUTION	
Attendees	
MINUTES PREPARED BY  <b>Fatima Shah</b>	SIGNATURE  التوقيع
APROVED BY  <b>Eiman Al-Awadhi, Chairman (acting)</b>	SIGNATURE  التوقيع