



Bifunctional Rotating Drum Electrode Device and Method for Treatment of Persistent Organic Pollutants IITM Technology Available for Licensing

Problem Statement

- In the present era, the availability of clean potable water at affordable cost is a growing challenge for mankind. To meet the growing demand of drinking water, many materials & methods are used, but having difficulties due to **expensive** process/implementation, & **consumption of high energy**.
- There are many conventional methods discussed herein does not provide solutions as discussed in the present invention.
- Hence, there is a need to address the issues.

Technology Category/ Market

Technology: Bifunctional Reactor Device;

Industry & Application: Environment Engineering, Waste treatment, Treatment for organic pollutants;

Market: The global **small modular reactor** market is projected at a **CAGR** of **3.6%** during (2024-2030)

Technology

- Present invention describes a **bifunctional reactor device** and a **method** for removal of persistent organic pollutants in water.
- The device includes a **MoS₂-TiO₂ coated carbon cloth material** as **anode** and **graphene-ferrocene/graphene-hemin coated graphite felt** or a **combination** as **cathode**.
- **Each** of the **electrodes** is **wrapped** in an **individual drum**, each drum held by a **rotating shaft** and **is configured** such that **half the drums** are **submerged in the waste water** while the **other half** is **exposed to air**.
- The feed entering the **reactor device** forms a **liquid thin film** on the **surface** of the **electrodes**.

- The **exposed liquid thin film** adsorbs **oxygen** from **atmosphere** and **UV irradiation** resulting in effective **degradation of organic pollutants** adsorbed on the liquid thin film.
- Further said invention discloses a **process to degrade pollutants in a solution** as shown in figure hereinbelow:

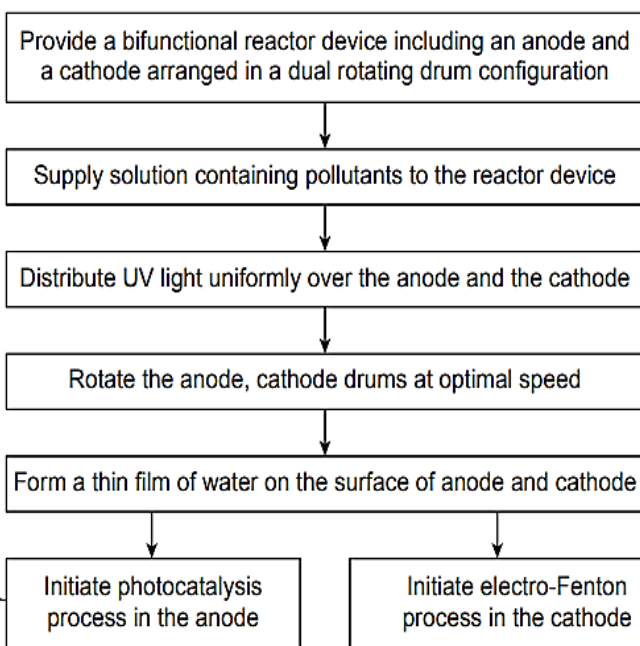


Fig. 1 Illustrates a process to degrade pollutants in waste water;

Intellectual Property

IITM IDF Ref. 1607; Patent No:487475;

TRL (Technology Readiness Level)

TRL-4, Proof of concept tested in Lab;

Research Lab

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Key Features / Value Proposition

❖ Technical Perspective & Industrial Perspective:

- ❖ Facilitates **Clean & Green** technology of bifunctional reactor device for the removal of dual phase contaminants.
- ❖ **Types of Electrode Pair used:** a) An anode wrapped around a first nonconductive cylinder, wherein the anode comprises of a carbon cloth coated with an anode composite to a predetermined thickness, the anode composite comprising **25 to 75 wt.% of molybdenum disulfide and titanium oxide**. b) A cathode wrapped around a second nonconductive cylinder, wherein the cathode comprises of a graphite felt coated with a cathode composite to a predetermined thickness, the cathode composite comprising **graphene-ferrocene, graphene-hemin or a combination** thereof, wherein **graphene content** present in the cathode composite is at least **99%**.
- ❖ **Electrode Arrangement:** The anode & the cathode arranged in a **dual rotating drum configuration** configured to **rotate about their individual axes** comprising a **first rotating shaft** coupled to a **first motor** & a **second rotating shaft** coupled to a **second motor**; and a **UV source** configured to **uniformly irradiate** the surface of the cathode & the anode.
- ❖ **Removing** Cations & Anions & positive-negative charges in approximately in the range of **0.1 to 10 Hours**, depending on the embodiment of the .
- ❖ **Efficiency:** The device & method work over a **wide pH range**, & achieve a removal efficiency of at least **90%**
- ❖ **Cost-effective & Plug & Play** system, provides **single solution** & applicable in the **domestic/Industrialist** area.

Image

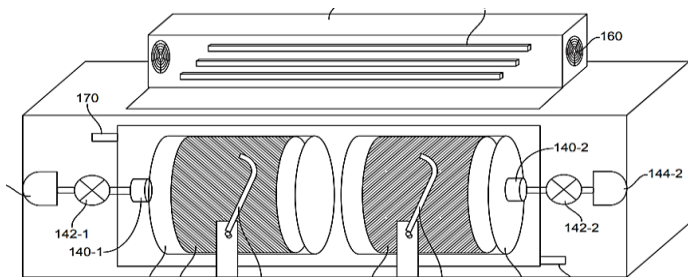


Fig.2A: Illustrates Bifunctional rotating drum reactor (BRDR) device for degrading organic pollutants in waste water.

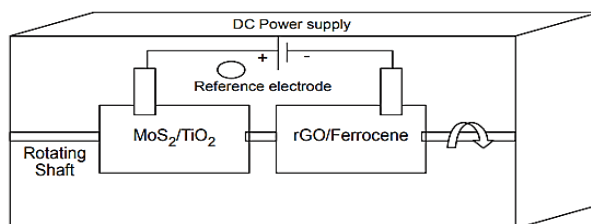


Fig.2B: Illustrates top view of the Bifunctional rotating drum reactor (BRDR) interior

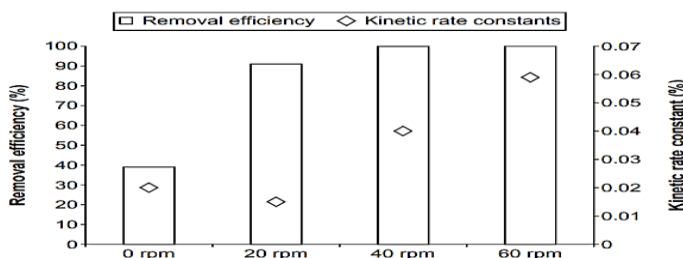


Fig.3A: Illustrates degradation of ciprofloxacin by integrated BRDR device under experimental conditions of 0, 20, 40, 60 rpm rotational speeds; pH 7.0, initial concentration of ciprofloxacin 20 mg L⁻¹; 1.5 V.

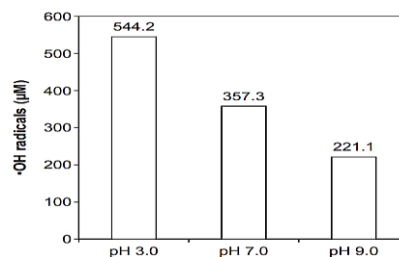


Fig.3B: Illustrates Estimation of radical production in the BRDR reactor at 40 rpm rotational speed; pH 7.0; 100 mM DMSO; 1.5 V.

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