Design and Fabrication of Oil Skimmer with Electrolysis

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Abstract: Aim of this project is to remove the oily effluent and chemical compounds from industrial waste water. A free floating endless belt oil skimmer was developed as means of recovering spilled oil from surface water. The skimmer utilizes a unique high efficiency belt which is driven by motor. As of chemical separation, which aims at serving the humanity toward planet, having an ability to perform electrolysis by using carbon rods to the waste water. By removing oil and chemicals we can preprocess water for other use. Electrolysis is a process that involves the generation of coagulants from an electrode by the action of electric current applied to these electrodes. This generation of ions is followed by electrophoretic concentration of particles around the anode. The ions are attracted by the colloidal particles, neutralizing their charge and allowing their coagulation. The hydrogen gas released from the cathode interacts with the particles causing flocculation, allowing the unwanted material to rise and be removed.

Keywords: Oil and water recovery, Oleophilic Skimmer,Electrolysis system, Modeling,Switchable oil/water separation, Mechanical stability.

1.Introduction:

Industrial development in recent decades has been a major contributor to the degradation of water quality, both through negligence in treatment of wastewater before discharge into receiving bodies and accidental pollutant spills in aquatic environments. The oil industry is a major source of pollutants that degrade the environment, with the potential to affect it at all levels: air, water, soil, and consequently, all living beings on the planet. The use of electrolysis can enable the release into receiving bodies or reinjection in wells of the treated electrolysis fluent by reducing the organic load and removing oily and solid particles in suspension. According to, the current electrolysis technology inherently involves the formation of an impermeable oxide layer on the cathode and deterioration of the anode due to oxidation. This leads to loss of efficiency of the electrolysis unit. These limitations of the process have been decreased to some extent by the addition of parallel plate electrodes in the cell configuration. Oil skimmer is device which is designed for the sole purpose of retracting the oil from the industrial waste water. A skimmer is defined as any mechanical device specifically designed for the removal of oil from the surface of water without altering the water's physical and/or chemical characteristics. Electrolysis is the process by which ionic substances are decomposed into simpler substances when an electric current is passed through them. Oil is one of the most important energy and raw material source for synthetic polymer and chemicals worldwide. As long as oil is explored, transported , stored and used their will be the risk of a spillage. Oil pollution , particularly of sea and navigable water, has exited more public concerned than other water or spilt materials. Oil pollution of the sea has steadily increased with the increase in oil comsumption.The bulk this in flux is due to transportation related activities spill from tanker loading and unloading operations, pipeline rupture which may be due to industrial waste as leakage from engines, incorrect operations of valves and discharge of oily wastages. Oil pollution of the shore in addition to the reduction of amenity, also affects marine, shore life and vegetation. Crude oil consists of different hydrocarbon that range from light gas to heavy solids. When oil is spilled on water, the physical and chemical properties of

oil change progressively. Spilled oil has an undesirable taste and odour and causes sever environment damage on water fall, material life and affects tourism economy. In the present text, we evaluate the efficiency of electrolysis technique with direct current and variable frequency alternating current with the use of aluminum electrodes for the treatment of oily wastewater from actual production.

2. Literature survey:

P.Madhusudhana Reddy et al [1] did experimental studies on Polystyrene and poly (butyl acrylate) grafted Fe3O4 nanospheres were fabricated through facile and inexpensive method. These nanospheres can sequester oil from both the oil–water mixture and oil-in-water emulsions. Further, these materials also can absorb multiple oils. Jingyuan Liu et al [2] experimentally analyzedthe as-prepared Ni foam could be used for the separation of oils and organic solvents from water. Compared to other methods and materials for Separation of water and oil, the as-prepared Ni foam has advantages of an efficient and high degree of separation.

CorneliuCojocaruet al [3] demonstrated that electro spinning is an effective technique to produce polysulfone fibrous sorbents for oil spill cleanup. On the basis of experimental design, two multiple regression models were developed and statistically validated by ANOVA test. ZainabNgainiet al [4] found that Natural fibers are among the alternatives for oily wastewater treatment for their simplicity, excellent oil removal properties, environmentally friendly characteristic and easy availability and feasibility. AlirezaKeshavarzet al [5] found that surface modification of PUF by MWCNT is very favorable for increasing oil removal ability. The results on the reusability of the sorbent with 1 wt% MWCNTs on its surface after four cycles of regeneration has shown that 85.45% of the oil sorption capacity remains.

Leila Fereidooniet al [6] found that, in the electrolysis method, the region near the cathode is the most active region for Tranesterification where water molecules were continuously electrolyzed and the absence of catalyst problematized the formation of FAME Substantiating the fact that the electrolysis by itself did not promote the trans-esterification.

Pierre Olivier et al [7] found that Electrolysis is a crucial technology in the pathway to hydrogenEnergy development. Electrolysis system is characterized by complex and nonlinear models because of different energies coupling, non-stationary and spatiotemporal dynamics.

Marco Bellagambaet al [8] experimentally analyzed that, the effect of electrolysis on the redox potential extended several centimeters upward from the anode surface, thereby indicating that the Radius of influence of the technology is probably much greater than that reported for Otherbio electrochemical TPH remediation technologies based on direct electron transfer to electrodes.

Hamid Zilouei et al [9] found that, the tobe very convenient for skimming the oil for the operator. It removes about 70 to 80-lit oil per day. It is very much helpful to operators, as it avoids their tedious work of skimming the oil and grease from the wastage water.

Mamta Patel et al [10] found that the function of oil skimmer, its various design aspects and performance. All the results of experimental studies indicate that slight design improvement of typical oil skimmers towards to include additional belt shaft and use of belt with steel material instead of rope.

D.R.Topham et al [11] found that many oils tend to form slicks of uneven thickness, and this, combined with the sensitivity of the oil concentration to flow rate in the range of many of the tests,. Any unevenness in the flow caused by leveling problems or wave action would lead to variations in oil concentration. The simple Froude number scaling of the model can be used to present the results in a universal form.

Chunchang et al [12] experimentally analyzed that the recovery capacity of two skimmers significantly decreases of thickness. In this sense commander of oil spill response should take this finding two consideration to deploy skimmer as soon as possible.

Victoria Broje et al [13] found that the material on the recovery surface can affect the recovery rates. For a thicker oil slick and low viscosity oil, the Neoprene drum was slightly more efficient than aluminum or

polyethylene drums. For 25 and 50mm oil slicks, the difference between materials was about 20%.

Yunshan Jiang et al [14] found that the fabricating technique of the Janus CNTs PANEN membrane via electro spinning and subsequent CNTs network coating is remarkably facile, cost effective and resource saving because an ultralow amount (1.6-31.8 mg) of CNTs is sufficient for making a square meter of the Janus nanofiber membrane.

Sara Monastero et al [15] found that integration of a plug-flow electrochemical reactor with a stack of miniature air-cathode MFCs is proposed. This integrated system allows the simultaneous treatment of algal biomass in wastewaters and energy generation

.Mecmet Ali recaiOnal et al [16] experimentally analyzed after complete leaching of the magnet powder in dilute sulfuric acid solution, ferrous iron (98% of dissolved Fe) could be oxidized to ferric iron by MnO2 within 1 h at room temperature and could be precipitated as akagenite by using certain bases at low temperatures (60 °C).

Han Yanbe et al [17] found that the removal efficiency of COD and chroma of dyes wastewater treated by the ICE reactor depend on reaction time, Fe/C, pH and aeration amount. The performance of the ICE reactor with the CIM is superior to that of the conventional reactor with the CRIF.

Tusharpathare et al [18] found thatThe belt slips slightly on the drum due to the collection of the oil. Water drops are collected simultaneously with oil and this is to be reduced for better performance.Stirrer mechanism can be used to improve oil removal rate.

Yan song et al [19] experimentally analyzed that Thesuperhydrophobic materials show excellent chemical stability and mechanical durability.The prepared samples can adsorb underwater oil droplets and oil slicks. Meanwhile, the as-prepared meshhas high separation efficiency. With excellent water-repellency and durability, these surfaces will have along cycle life in applications.

Wencexu et al [20] found that Finding new methods to fabricate amorphous phosphides containing multi-elements might solve the problemin the future. The development of bifunctional catalysts for theelectrolysis of water is very attractive for highly efficient water electrolysis.

Haizhu et al [21] experimental analyzedsuperwettable materials have diversified into other areas, such as microfluidic devices, printing technologies, sensors, optical devices, water harvesting, anti-bioadhesionmaterials,antifoulingmaterials, electrical responsive filters and so forth.

E.V.dossantos et al [22] found that Sonolysis of soil-washing waste containing oxyfluorfen results in a very soft oxidation of the micelles. The addition of the effects of sonolysis and electrolysis is below the observed for the combination of the technologies in a single stage. This means that sono-electrolysis is a synergistic technology.

Rohityadav et al [23] found that The trial taken shows that design satisfies its purpose. It is found tobe very convenient for skimming the oil for the operator. It removes about 70 to 80-lit oil per day. It is very much helpful to operators, as it avoids their tedious work of skimming the oil and grease from the wastage water.

Manoj kamble et al [24] found that the main purpose of project to remove the waste oil from sugar factory. The project is important for increase the sugar factory efficiency. The waste oil can be recycled for other purposes like greasing, lubricating. etc. the recycled water can be used for the various application in sugar factory. The model can reduce the load of water and increase the plant efficiency.

Ruosongxie et al [25] found thatA newly designed electric-assisted micro-electrolysis filter (E-ME) was developed to investigate its degradation efficiency for coking wastewater and correlated characteristics. It could be concluded that-ME showed a prominent synergistic effect on COD removal compared with SE and ME systems, GC–MS analysis indicated that the degradation of phenolic compounds was reinforced after an applied electric field was coupled with ME.

Christian Ziems et al [26] found that the applicability of the pressurized electrolysis system is determined by such factors as intended use, its ability to handle intermittent loading, choice of materials, and parameters related to construction and processes. As part of process-related optimization, investigations are to be made regarding heat management, circulation, and performance under partial loading and overloading.

Jingang Yao et al [27] experimentally analyzed that The technical assessment showed that the DFB biomass steam gasification process had nearly twice the H2 conversion rate of the BSR process. The alkaline electrolysis process had significantly lower investment costs compared to the other two processes but had the highest production costs.

Alexander Buttler et al [28] studied that alkaline electrolysis (AEL) represents the most mature technology. Twenty manufacturers of AEL could be identified that offer single-stack capacities up to 6 MW. Historically, AEL was designed for stationary applications and has to be adapted to the new flexibility requirements. In contrast, the development of PEMEL has been driven very strongly by flexible energy storage application in recent years.

Haojiang Wu et al [29] found that Fractal dimension is used to quantify the characteristics of the differential pressure signals at different flow conditions. Results show that the method has the merits such as easy computation and easily quantifying the characteristics of the measured signals, which standby well for the identification of the flow regime with neural network.

Yang Jin et al [30] studied that the cathodic–anodic-electrolysis packing prepared from DSD Acid industrial iron sludge, clay was easy to produce. Moreover, low-cost waste resources were reused in the process. The removal of pollutants during wastewater treatment by the packing is very favorable, and the removal of TOC and pyridine can reach 50% and 58% under the optimum conditions.

Conclusion:

In the present study, we could confirm that the electrolysis process produces satisfactory results for treatment of oily wastewater, allowing its discharge into water bodies or reinjection in oil Formations. Belt type Oil Skimmer is easy, effective, economical and environmental friendly system to tackle the global crisis of the oil spill. It can effectively clean the water surface recovering most of the oil back in usable form. The hazardous effects of oil spill and industrial waste water are thus effectively reduced and lots of human efforts are eliminated.

Future scope:

Speed of the belt cannot be vary so it is to be improve by providing multispeed arrangement. Stirrer mechanism can be used to improve the oil removal rate.

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