DOWNLOAD PDF WASTEWATER TREATMENT FOR PETROLEUM REFINING AND RELATED IN

Chapter 1 : petroleum refinery wastewater Articles | Environmental XPRT

EPA is soliciting data from 9 petroleum refining companies related to their wastewater characteristics. The request pertains to the types of processing units, wastewater treatment technologies, and related information.

Environmental Protection Agency, have been grouped into nine series. These nine broad cate- gories were established to facilitate further development and application of en- vironmental technology. Elimination of traditional grouping was consciously planned to foster technology transfer and a maximum interface in related fields. The nine series are: Environmental Health Effects Research 2. Environmental Protection Technology 3. Socioeconomic Environmental Studies 6. Interagency Energy-Environment Research and Development 8. This series describes research performed to develop and dem- onstrate instrumentation, equipment, and methodology to repair or prevent en- vironmental degradation from point and non-point sources of pollution. This work provides the new or improved technology required for the control and treatment of pollution sources to meet environmental quality standards. This document is available to the public through the National Technical Informa- tion Service, Springfield, Virginia Kerr Environmental Research Laboratory, U. Environmental Protection Agency, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the U. Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. As one of these facilities, the Robert S. Kerr Environmental Research Laboratory is responsible for the management of programs to: This report contributes to the knowledge essential if the EPA is to meet the requirements of environmental laws that it establish and enforce pollution control standards which are reasonable, cost effective and provide adequate protection for the American people. Galegar, Director Robert S. The recent interest in removal of toxic compounds generated by the settlement agreement between EPA and the Natural Resources Defense Council has also led to consideration of activated carbon adsorption as a part of an industrial wastewater treatment scheme. A review of the literature on activated carbon adsorption as a treatment concept for petroleum refinery, petrochemical plant, and combined industrial- municipal wastewaters is presented in this report. The principal time period reviewed was A total of references are cited. These references cover the various aspects of carbon adsorption and its application in the treatment of industrial and municipal wastewaters. An additional 65 references are listed in the Bibliography. These include literature from foreign sources, literature not located during the original search, and literature published after the original search was completed. There is ample evidence in the literature reviewed to suggest that activated carbon adsorption, using either granular or powdered carbon, should be considered when evaluating treatment alternatives for industrial waste- waters. Successful applications of this mode of treatment have been claimed at numerous municipal, industrial, and combined municipal-industrial instal- lations. There is enough variations in the adsorption behavior of organic compounds so that adsorption may not always provide a suitable removal process. Each industrial operation has its own effluent characteristics and requirements. Availability of land, complexity of operation, cost of treatment facilities, and variations in wastes all combine to make each wastewater treatment system unique. The optimum treatment system for any given operation can be designed only after careful study of the entire problem and preliminary evaluation of several alternate designs. Characteristics of these wastewaters vary considerably. Both quality and quantity may fluctuate significantly within a plant. Differences may be even greater between different facilities. In recent years it has become apparent that conventional biological treatment may not be the optimum solution to all waste treatment problems. Although conventional biological processes are designed to remove organic material from wastewater, neither the trickling filter nor the activated sludge process effectively removes the last portion of this organic material 4. This material, soluble or colloidal, resistent to biological degradation, is often termed "refractory. Furthermore, operating difficulties, sludge handling prob- lems, and large land requirements are intrinsic to biological processes. These factors have led to consideration of alternative treatment processes. Of all advanced waste treatment processes, activated carbon adsorption is getting the most attention by industry and appears to be applicable in refinery and, to some extent, petrochemical operations 6. It is not expected that any one process will be universally applicable. The varied nature of the problem, the character of the wastes to be treated, the geographical and logistics considerations, the extent of reuse required, etc. The use of activated carbon for removing dissolved organics from drinking water and wastewater has long been known to be feasible. The increasing need for highly polished effluents, necessary to accommodate stringent requirements for both surface water quality and water reuse, has stimulated great interest in carbon treatment systems. Adsorption makes it possible to remove compounds that are not readily degradable by biological methods and gives excellent removal of taste, color, and odor 7. Cooper and Hager 8 stated that activated carbon is effective in removing refractory compounds. Furthermore, carbon is effective in adsorbing organics below the concentration where bio- logical treatment systems are efficient. Hager and Reilly 9 presented data showing that the adsorption process can produce a considerably higher removal of organic contaminants than could be expected from the activated sludge process alone. Kwok 10 observed that activated carbon exhibits a strong adsorptive affinity and an appreciable adsorptive capacity for a wide variety of organic compounds. Adsorption on activated carbon, both granular and powdered, has been investigated extensively in recent years because of the ability of carbon to adsorb organic materials from wastewater Coughlin 13 states that activated carbon is one of the most promising solid adsorbents for removing organic compounds owing to its commercial availability, high adsorption capacity, and affinity for a broad spectrum of chemical compounds. Hager and Reilly 9 report that a wide variety of industrial wastewaters are presently being treated by granular activated carbon. Swindell-Dressier Company in their manual on carbon adsorption prepared for the Environmental Protection Agency Technology Transfer 14 report that the use of activated carbon for removal of dissolved organics from water and wastewater has long since been demonstrated to be feasible. In fact, it is one of the most efficient organic removal processes available. Both the great capability for organic removal and the overall flexibility of the carbon adsorption process have encouraged its application in a variety of situations. The process readily lends itself to integration into large, more comprehensive waste treatment systems. Loven 15 reported that the carbon process, usually in conjunction with other processes, functions to remove gross oxygen-demanding and refractory organics, color, and specific pollutants such as phenolic compounds and chlorinated hydrocarbons. Loven feels that as the trend continues toward increased limitation on discharges of hazardous substances, the need for carbon treatment grows. Physicochemical treatment has proved to be a viable method for achieving improved effluent and receiving water quality. The nucleus of most physico- chemical treatment plants is an activated carbon system The authors reported that in more than 20 municipalities in the U. According to Weber and Crittenden 16 , this number is expected to increase rapidly in the next decade. Sigsworth 17 has reported the use of active carbon in a number of industrial applications for reclaiming solutions which otherwise might consti- tute wastes. A broad-range study of a number of industrial wastewaters has shown activated carbon adsorp- tion to be applicable as a viable treatment alternative 19, Granular activated carbon treatment of water and wastewater in large volume systems began in the U. Hager purposed that the development of granular activated carbon capa- ble of reactivation and reuse made adsorption an economic alternative for removal of dissolved organic contamination from wastewater. Gulp and Gulp 21 stated that the use of granular activated carbon for the adsorption of organic materials from wastewater has become firmly estab- lished as a practical, reliable, and economical unit process for water pollution control. Although no unit operation represents a universal cure for dissolved organic removal, the adsorption process utilizing granular activated carbon as a domestic tertiary system has been reported as leading all others in acceptance 22, 23 Cover and Wood 24 reported that tertiary wastewater treatment with granular activated carbon has been found to be an efficient and reliable process for organics removal. The authors stated that granular carbon has proved itself capable of removing such organic chemical compounds as phenol, polyols, herbi- cides, pesticides, detergents, trinitrotoluene, dyes, and a host of pollutants measured as BOD2, COD, TOG, color, and odor. Davies and Kaplan also noted that powdered carbon systems have faster adsorption rates than granular systems but that utilization had been limited because of difficulties in handling and regeneration. Powdered activated carbon was first reported as an aid to sewage treatment for overloaded activated sludge plants in Carbon was observed to improve sludge compaction and filtration. Operating under all the typical quantity and quality variations encoun- tered in a full-scale sewage treatment situation, Burant and Vollstedt 29 demonstrated that powdered activated carbon used in an activated sludge type process is capable of producing an unusually high-quality effluent. Exten- sive, full-scale field tests involving a variety of industrial and municipal wastewaters have demonstrated that powdered activated carbon improves organics removal, solids settling, color removal, and foam reduction when added to activated sludge treatment processes 3, 30, No one process, however, can be expected to be the ultimate solution for all wastewater treatment problems. Carbon adsorption is no exception. It is only one of several alternative treatment processes which should be considered for use in a given situation. An optimum treatment system can be selected only after careful evaluation of these alternatives. The purpose of this report is to present a review of the available literature on activated carbon adsorption as it pertains to the treatment of petroleum refinery, petrochemical plant, and combined industrial-municipal wastewaters. A review of the literature pertaining to adsorption kinetics and process design criteria is also presented, since these aspects are crucial for successful application of the adsorption process for treatment of any wastewater. Full-scale granular activated carbon installations are currently removing toxic or biological refractory contaminants from wastewaters, and exhausted carbon is being reactivated for reuse Cover and Pieroni 33 presented a literature review of tertiary waste- water treatment giving special attention to activated carbon adsorption. Hager and Fulker 34 discussed the use of granular carbon in wastewater treatment. Examples of industrial and municipal application are given. Ford 35 prepared an excellent treatise presenting pertinent and current informa- tion on activated carbon treatment of municipal and industrial wastewaters. This comprehensive paper contains 33 references, 24 figures, and 30 tables. Basic concepts are included as well as case histories with which the author is familiar. The effectiveness of tertiary treatment for domestic and some industrial wastewaters has been demonstrated in many bench and pilot-plant studies and amply confirmed by plant-scale operations However, tertiary treatment is not without limitations. Operation of the secondary stage can be adversely affected by: These limitations led to investigations of direct applications of advanced waste treatment processes to raw wastewater usually after primary separation of visible sol- ids. The author noted that cumulative data from bench and pilot-plant re- search have been impressive. Much of the information presented is based on evaluation and operation of pilot, demonstration, and full-scale plants. Cohen 5 presented a comparison of carbon adsorption and activated sludge treatment processes for removal of organic material from a primary effluent. Results of the 6-week study conducted at Lebanon, Ohio, showed that carbon adsorption was more efficient in the removal of organics than activated sludge. Cohen and Kugelman 37 described a system of physical-chemical treatment using carbon adsorption, surveyed the performance of some pilot plants, and gave cost estimates for various sized plants. Not only was the organic content significantly reduced, but the feasibility of reactivation and reuse of granular carbon in wastewater treatment was demonstrated. Direct application of adsorption by granular activated carbon to a primary effluent was examined and reported on by Weber et al.

Chapter 2 : Refinery Effluent | Aquatech

Among these, the most heavily polluted wastewater stream that requires serious treatment is the process water and steam that come into direct contact with petroleum fractions. Storm water may be contaminated because of incidental exposure to pollutant sources on refinery surfaces and accidental spills.

Chapter 3 : Wastewater Treatment | FSC Petroleum Refining

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Petroleum refining water/wastewater use and management IPIECA Operations Best Practice Series This document was prepared by AECOM, Inc. on behalf of the IPIECA Refinery Water Management Task Force.

Chapter 4 : Wastewater Treatment

Wastewater treatment Waste waters from petroleum refining consist of cooling water, process water, storm water, and sanitary sewage water. A large portion of water used in petroleum refining is used for cooling (may contain hydrocarbons due to leakage). Process wastewater is usually highly contaminated depending on the process. Storm water (i.e.

Chapter 5 : Petroleum Refining Effluent Guidelines Studies and Guidance | Effluent Guidelines | US EPA

In the first stage, the most successful type of refinery wastewater biological technology, complete mix activated sludge, is utilized for removal of the oil and grease and related petroleum hydrocarbons.

Chapter 6 : Primary and secondary treatment processes | FSC Petroleum Refining

EPA is soliciting data from 9 petroleum refining companies related to their wastewater characteristics. Technical Support Document for the Effluent Guidelines Program Plan; Section 7: Petroleum Refining (PDF) (pp, K, August , R).

Chapter 7 : Petroleum Refining Effluent Guidelines | Effluent Guidelines | US EPA

PETROLEUM REFINING Numerous comparative pilot granular studies and several full-scale in- plant powdered carbon evaluations have been conducted by ICI United States, Inc., to determine the effectiveness of carbon in solving refinery wastewater treatment problems (3).