ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Effective Sorbents with High Adhesion for Oil Products.

Myrzalieva SK[1], Kozybayev A[2], and Zhexenbay N[2]*.

[1]Department of Chemical Technology of Processing of Petroleum, Gas, and Polymers, Kazakh National research technical university after K.I. Satpayev, Satpayev str. 22, Kazakhstan.
[2]Accredited testing laboratory «Food Safety», Almaty Technological university, Tole bi str. 100, Kazakhstan.

ABSTRACT

The objective of this paper is to review the characteristics of the different treatment of oily water by sorption materials and description of the main characteristics that define an efficient use of oil sorbents, filter materials and activated carbons in the process of water purification from oil products. Prevention of oil pollution of the hydrosphere and the elimination of its consequences - is one of the complex and multifaceted problems of protection of the environment, promising solution is the use of sorption purification technologies.
Keywords: water pollution, treatment, oily sewage water, plant waste, sorbent.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

The problem of water pollution is now urgent in connection with the continuing growth of the anthropogenic load on the environment. Environmental problems are pronounced in those regions, which operate on the territory of chemical production.

The list of priority pollutants leading positions occupy oil and petroleum products (petroleum), heavy metals, products of organic and inorganic synthesis contained in the wastewater of dyeing and finishing, oil, electroplating and many other industries.

Oily waste water is divided into two different groups: the first - is the natural reservoirs of water, contaminated as a result of accidents and unauthorized discharges of oil products, as well as by surface runoff from urban and industrial sites, ports, etc.; the second - a waste water (WW), resulting from the technological processes at the objects of production, storage, processing and transportation of crude oil, washing of any type of transport, etc. Hard water quality requirements of drinking and household purposes in content petroleum necessitates removal of oil contamination of surface water and waste water, which can be reused or drain into natural bodies of water. Flow charts for the cleaning of oil polluted waters of these groups differ fundamentally. However, it unites them effective use of sorption materials for removing the pollutant at different stages.

Cleaning the surface of water bodies from contamination involves the removal of the oil film mechanical and (or) physical and chemical methods. The most promising and ecologically feasible is considered a method of removing oil film with the help of oil sorbents [1].

The effluent oil may be free, bound and dissolved states. Coarsely-free oil are removed as a result of settling. To remove finely dispersed and related petroleum traditionally used flotation cleaning methods, techniques and electrocoagulation electroflotation. These processes are oil in water to 20 mg / l. Deeper removal of fine, especially emulsified, oil and 10 mg / l is achieved in the filtration process. Removal of dissolved solids up to 0.5 - 1 mg / l occurs in step purification sorption [2, 3]. There are numerous methods of preparing sorbents and filter materials for purifying the water from the oil and flow charts of their application. The objective of this paper is to review the characteristics of the different treatment of oily water by sorption materials and description of the main characteristics that define an efficient use of oil sorbents, filter materials and activated carbons in the process of water purification from oil products.

Prevention of oil pollution of the hydrosphere and the elimination of its consequences - is one of the complex and multifaceted problems of protection of the environment, promising solution is the use of sorption purification technologies. Despite the variety of industrial adsorbents, their use is limited by the high cost, the fine shape, causing problems when using the complexity of recycling saturated absorber. Therefore, the development of technical solutions for wastewater and oil spills with new, cheaper and more accessible adsorbents is an important and highly relevant scientific applications. The raw material for the production of oil sorbent can be plant waste tonnage of agriculture, in particular. It allows to solve the problem of disposal of agricultural wastes and the production of materials used in environmental activities.

In recent years, increased significantly contribute to the pollution of the hydrosphere from numerous objects associated with the storage and marketing of crude oil and petroleum products. Location of tank farms, gas stations (petrol stations) and facilities (ACP) in the vicinity of settlements or in their territories dramatically increases the negative impact on the environment. The effectiveness of wastewater treatment systems of these objects can be significantly increased through the development and introduction of sorption units post treatment.

One of today's priorities in the field of environmental protection is to find efficient and environmentally sound technologies for wastewater treatment. A promising area is technology based on the use of sorbents. When selecting sorption materials should be guided by such parameters as the amount of sorption, cost, availability, efficiency, the possibility of secondary material resources, environmentally safe disposal of saturated sorbents.

In accordance with the above criteria, the analysis of the efficiency of the sorbents used. Sorbents based on inorganic materials have a low sorption capacity, hydrophilic, require additional modification to cause difficulties with recycling. Synthetic sorbents are convenient thanks to the good absorptive capacity, availability, however, are more cost, complexity of processing due to the high toxicity of combustion products.

The most attractive sorbents from waste plant matter. Practically unlimited supplies of these materials and their low cost, simple technology of production, ecological safety refining processes used sorbents, as well as relatively high adsorption, ion exchange and filtration properties of sorbents promote research aimed at obtaining new adsorption-active materials from plant material. As such, it can be isolated from the sorbent corn wastes. This sorbent is a cellulose-containing raw materials are, has a spongy space-frame structure. It has high hydrophobicity and in contact with an oily film on the surface of the water is selective absorption of fat only. The spent sorbent requires no regeneration costs, can be used as a valuable feed for livestock, and is widely used in the composition grain stem feed mixtures as a source of fiber, filler, etc. premixes.

Practically unlimited supplies of these materials and their low cost, simple technology of production, ecological safety refining processes used sorbents, as well as relatively high adsorption, ion exchange and filtration properties of sorbents promote research aimed at obtaining new adsorption-active materials from plant material. The role of natural sorbents can perform a variety of organic materials.

These include waste from the food industry, wood processing and agriculture. This group of waste include peel plants and vegetables, nut shells, husks, straw and bark.

Sorbents based on natural, due to weak sorption properties need to be modified. For this purpose both chemical and physical methods.

Oil is one of the most dangerous groups of substances that pollute the biosphere. In case of insufficient wastewater treatment from oil products, falling into bodies of water, they adversely affect the microorganisms living in them, algae and aquatic life.

Currently, developed a variety of methods of sewage treatment, however, the high cost and complexity of implementation of treatment processes to limit their practical application. Increasing the scale of production and increasing requirements for water quality dictate the search for more effective ways to remove pollutants from the natural environment and the return of treated wastewater for reuse.

Among the methods successfully applied to solve this problem, sorption purification is one of the most effective. The advantages of sorption method include the ability to remove contaminants is extremely broad nature to almost any residual concentration irrespective of their chemical stability, and no secondary pollution control process. Sorption allows for deep cleaning of the water up to the standards of Threshold limit value (TLV) of pollutants in the water industry, working, sanitary, household and fishing industry with the simultaneous disposal or recovery of the extracted components.

Many substances of natural and anthropogenic origin have the properties of sorbents such as ash, coke, peat, silica gels, alumina gels, activated carbons, clay, sawdust, etc. It was found that the properties of sorption and wool. The sorption properties of wool are determined by the peculiarities of the physical and chemical structure of the fibers, as well as applied sorbate.

However, more promising, given the final use of wool and its high cost, is seen to use for cleaning WW formed at different stages of processing of raw wool. Moreover, to improve the adsorption capacity of wool relative to possible oil by chemical and physico-chemical modification.

Every year the quantity of pollutants in the environment is growing rapidly, which is primarily related to the production activities of man. Environmental pollution has become an international problem that requires an urgent solution, on which depends the life of future generations.

One of the global problems of global pollution is oil and products of its processing.

ISSN: 0975-8585

Anthropogenic pollution of surface water bodies and pools of petroleum products in the area of the industrial facilities of the oil industry takes place in industrial activity as a result of violations of the integrity of oilfield facilities, oil spills, as well as organized and unorganized run off from industrial sites with rain, snowmelt and watering waters. This is a problem in Kazakhstan due to the depreciation of equipment and non-compliance with the technological discipline of industrial enterprises. If you get oil on the surface of water bodies greatest danger is its rapid spread over large areas, leading to disruption of the ecological balance in the environment and the normal functioning of biological systems for a long time.

Oil Spill solved by the installation of booms, stationary oil traps, the use of skimmers, etc.

Small debit watercourses (streams, small rivers) and their pools occurring in the zone of influence of industrial facilities of the oil industry, are vulnerable from anthropogenic impact. Removal of oil and oil products from the surface of small debit Watercourses requires rational, low-cost and effective technical solutions.

As international experience shows, in most cases the best results from the cleaning of oil streams is achieved using synthetic sorbents that exhibit high sorption properties, and can be recovered. For effective materials possessing sorption properties of petroleum products are waste products from agricultural raw materials, the volume of which is increasing every year.

MATERIALS AND METHODS

Analysis of purity water sample by photometrically oil carried on digital spectrophotometer Jenway 6705. Analyzed water quantitatively transferred to a separatory funnel by checking the volume of test liquid. Vessel where water was investigated, rinsed with hexanes (10-20 ml) at a ratio of water / organic phase of 5: 1 hexane quantitatively transferred to a separatory funnel with the test liquid. Within 30 seconds, producing an active mixing of fluids in a separatory funnel and allowed to separate the layers. The lower aqueous layer was discarded and the clear upper layer was transferred to the cuvette absorbance was measured on a digital Jenway 6705 Spectrophotometer using filter (X = 540 nm). In case of heavy pollution extractant must be diluted and re-measure. The calculation is performed taking into account the dilution factor.

The mass concentration of oil (C) in mg / l was calculated by the formula:

$$C = \kappa\, C_k V_1 / V.\ mg/l \qquad (1)$$

where C_k - the concentration of oil found on the calibration curve) mg / l
V_1 - volume of water sample, mL;
V - volume of hexane. ml; to the dilution coefficient.
The cleaning efficiency (Eff) was calculated according to the formula:

$$Eff = (C_o - C_k / C_o) * 100\% \qquad (2)$$

where C_o - the concentration of oil products to clean; C_k — concentration after cleaning.

RESULTS AND DISCUSSION

The degree of purification WW (%) oil using different sorbents plant origin and conventional activated carbon used is shown in Tab. 1 at a temperature of 40 ^{0} C and in Tab. 2 at a temperature of 50 ^{0}C.

Table 1: The degree of purification WW (%) oil using different sorbents plant origin and conventional activated carbon at 40 ^{0} C

Time absorption / Adsorbent	30 min	1 h	1,5 h	2,5 h	5 h
Woodchips	99,9	99	99,9	96,4	99,63
Sunflower husks	98,33	99,43	99,3	96,13	99,43
Corn wastes	99,8	99,1	99,6	99,7	99,8
Activated carbon	95,89	96,1	96,1	92	95,83

ISSN: 0975-8585

Table 2: The degree of purification WW (%) oil using different sorbents plant origin and conventional activated carbon at 50 ^{0} C

Time absorption / Adsorbent	30 min	1 h	1,5 h	2,5 h	5 h
Woodchips	99,47	95,7	97,46	97,2	98,06
Sunflower husks	96,86	88,8	98,73	98,36	96,1
Corn wastes	96,94	58,43	99,43	100	84,8
Activated carbon	95,91	90,56	96,63	88,6	95,13

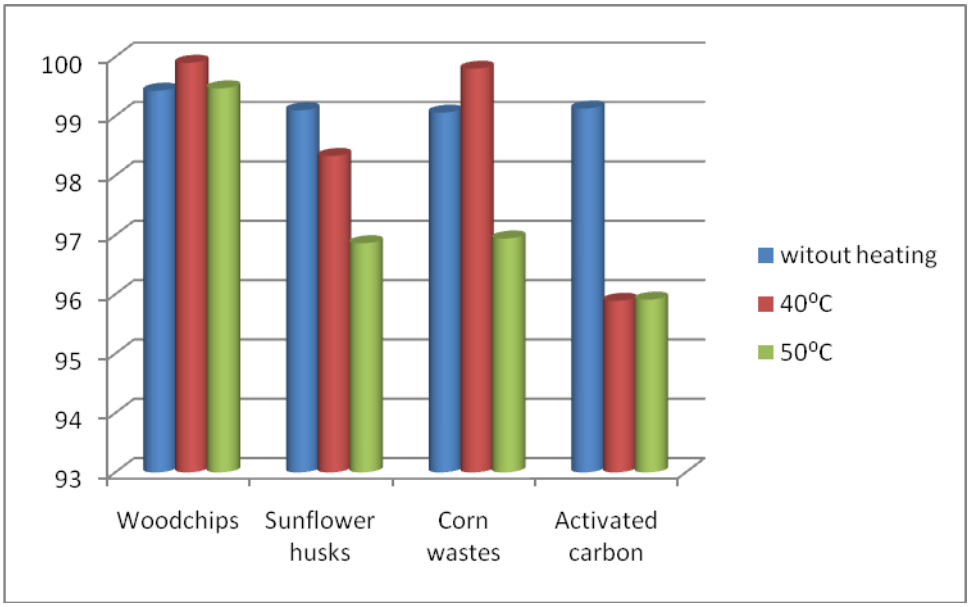

Figure 1: Dependence of the efficiency of purification WW at adsorption temperature for 30 minutes

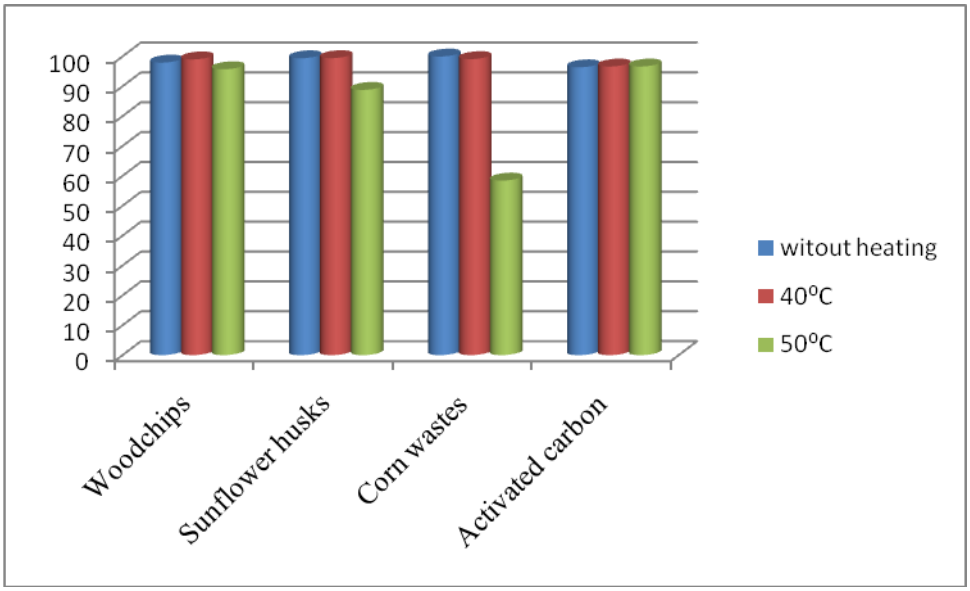

Figure 2: Dependence of the efficiency of purification WW at adsorption temperature for 1 hour

Woodchips are deposited on the bottom of the solution after 30 minutes. The adsorbent based on sunflower husks fine, free-flowing after treatment. It is known that the pores act as transport channels, and the adsorption capacity is determined mainly microporous structure which is an important indicator of the adsorbent. The micropores of radius less than 0.5 nm are not suitable for the adsorption of organic substances

from solutions, since they are practically inaccessible to the majority of organic molecules [3]. The greatest effect of extracting oil prevent pore diameter of 1.5 to 4.5 nm [6]. Corn wastes porous, such a structure increases the specific surface area and, consequently, the activity of the adsorbent.

Sorbents with high adhesion for oil products, can be effectively used to collect oil from the water surface. Space-porous sorbents to absorb oil and petroleum products by the capillary forces and retain pollutants in volume due to adhesion.

REFERENCES

[1] Myrzalieva S.K. Khamzina Zh.B., Dauletbaev A.D. Purification of industrial waste water of harmful heavy metals by ion exchange method features // Industry of Kazakhstan. -2011. - Number 3 - P. 310-312 (in kazakh).

[2] Myrzalieva S.K. Izazhanova A. Karzhaulova P. Actual problems of sewage treatment food industry // Proceedings of the International Conference of Students and Young Scientists "World of Science". - Almaty, 2011. - P.105-106 (in russian).

[3] Myrzalieva S.K. Alimkulov Zh.D., Mukhanova M. Eszhan S. Development of technology for the sewage treatment enterprises of meat and dairy industry of organic pollutants // Proceedings of the International Conference of Students and Young Scientists "World of Science". - Almaty, 2011. - P.130 (in russian).

[4] Gala A., Sanak-Rzdlewska S. Sorption of toxic metal ions from aqueous solutions on waste natural // Mining and Geoengineering, 2010. P. 42 (in russian).

[5] Bezdenezhnykh L.A. Shmandy V.M. Kinetic regularities of adsorption treatment sunflower Asla sorbent obtained from waste // Shidno-European Journal of advanced technologies. - Kharkiv, 2004. - 3 (9). - P. 88 – 91 (in russian).

[6] Veprikova E.V.,. Tereshchenko E.A, Chesnokov N.V., Tsapko M.L., Kuznetsov B.N. Features purify water from oil with the use of sorbents, filter materials and activated carbons. Journal of Siberian Federal University. Chemistry 3 (2013 3) 285-304 (in russian).