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Study of the effectiveness of nonwoven filters from textile waste

Silvena Boteva, Luben Tzankov[1], Margarita Neznakomova

Environmental Technology and Management Laboratory
Technical University of Sofia
8 Kl.Ohridski Blvd., 1756 Sofia, Bulgaria
tel: +359 2 37 07, fax: +359 2 868 01 41, e-mail: lic@tu-sofia.bg
website: http://etml.tu-sofia.bg

reasons for recycling of waste from textile products and processes –

- protection of natural resources,
- reducing the need of landfills and payment of fees,
- supply and provide cheap raw materials for new products

not very high percentage of recycled textile products - shortage of public willingness to participate in waste collection and recycling

textile waste remains in the form of textile dust that is usually landfilled

In the present report are presented results demonstrating the effectiveness of filter screens obtained by wet process for nonwovens production from textile dust from wool production.

It is examined:
-the degree of saturation of the filter depending on the:
- concentration of the contaminant (clean and used mineral oil)
- pressure and flow rate of the fluid
- number of nonwoven layers in the filter.

Oil and petroleum products are currently the main ocean pollutants:

- spills,
- floating on the water surface,
- dissolved and emulsified petroleum products,
- precipitation on the basin bottom (heavy oil fractions).

As a result, the taste, smell, color, surface tension and viscosity of the water change, the oxygen amount reduces, harmful substances form, water becomes toxic and is a threat to the flora and fauna.

Aim of the work

to demonstrate the possibility of using adsorption media produced by the wet process for nonwoven textile from waste textile powders with prevailing content of wool and to prove their effectiveness

Principle of adsorption purification:

1. Particles of oil or petroleum products come into contact with the surface of the fiber layer and a thin layer / film of the pollutant is formed on the surface due to adhesion interaction.

2. The passing of the water containing petroleum products through the barrier, the wetting of the fibers and their adsorption on the surface depends on the pressure of the fluid, the flow rate and the porosity of the barrier. This affects the efficiency of retention and purification.

Sorbents - various synthetic and natural porous materials: salts, coke pellets, peat, silica aluminogels and active clay.

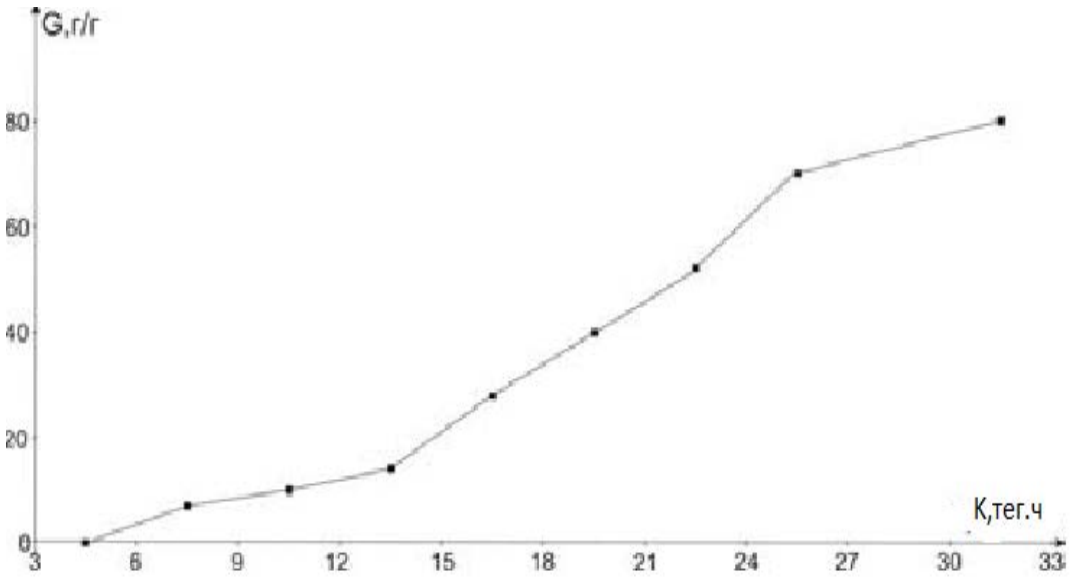
The most active and effective sorbent is the activated carbon - relatively high price.

main indicators of the sorbents - porosity, pore structure, chemical composition.

The activity of the sorbent is characterized by the amount of absorbed substance per unit volume or mass of the sorbent (kg/m^{3}kg/kg).

The filtration rate depends on the concentration of dissolved substances in the waste water and fluctuates from 1-2 to 5-6 l/h; the size of fibers in the sorbent is 1.5-2 to 4-5 mm.

The optimal direction of passing of the liquid is from the top down as in this case was observed even filling of the entire section of the column and bubbles of air and the gases trapped in the sorbent can be easily removed together with the waste water.

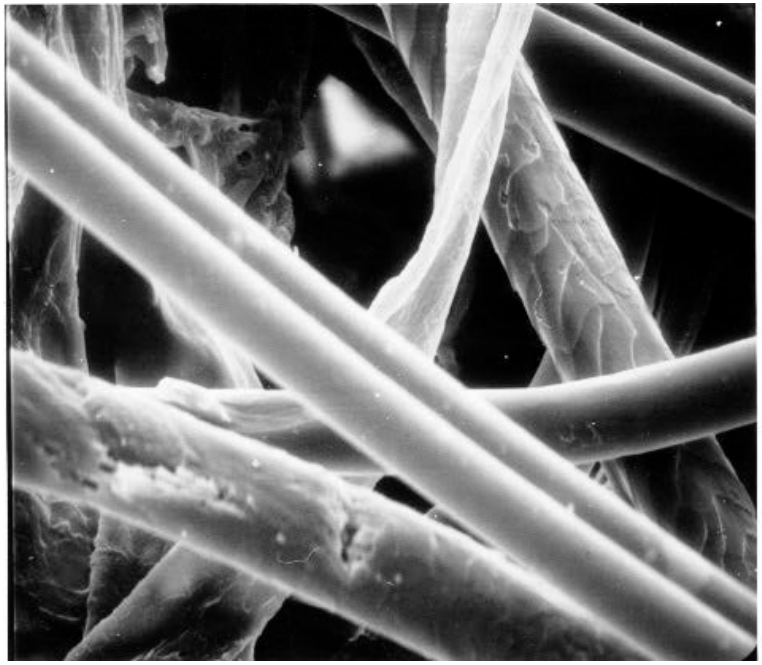


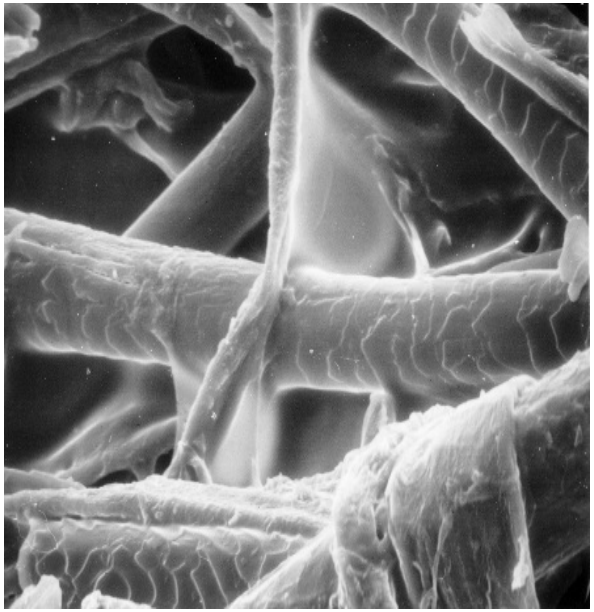
Influence of wool content in the mixture with polyester on the retention of oil and petroleum products.

The filter barrier of recycled fibers has a stable structure, air permeability coefficient Bp = 0.803-1.22 $m^3/m^2.h$, distribution of pore size of 212- 240 μm, an average pore size of about 226 μm, with an average thickness - 12 to 15 mm and area density 250 g/m^2, with an average dry and wet breakthrough strength respectively 13.15 dN and 10.65 dN.

Cross section of barrier of regenerated waste fibers obtained by the wet process

Filter media with bulk density 119 kg/m^3, can easily be installed in the filter body and has a hydrodynamic resistance F = 0.153 $kg.m/s^2$ and desired retention capacity of 20 kg/kg of oil; of machine oil- 18 kg/kg and kerosene - 12 kg/kg





Advantages of the technology for filter media of nonwovens (FMNW)

- the use of physical and mechanical principles for water purification without the need of chemicals in ordinary demulsifying chemical treatment plants

- the directions of the inlet and outlet pipe, and their size can be adapted to the local conditions

- water quality at the outlet of the system is not affected by the concentration of oil products in the water at the inlet

- the purified water can be discharged into the sewage system or can be used in a closed cycle, which drastically reduces water consumption

Parameters	Filter FMNW 120	Filter FMNW 130	Filter FMNW 150
Mass per unit area (g/m^2)	220	230	250
Air permeability, 100 Pa (m/s)	0,70	0,50	0,50
Class filter	Adsorption	Adsorption	Adsorption
Diameter (cm)	22	22	22
Thickness, mm	10	15	15
Maximum breakthrough strength (daN/5cm) - dry	13	15	15
Maximum breakthrough strength (daN/5cm), - wet	9	10	12
Operating temperature (^{o}C)	-30 to +140	-30 to+140	-30 to+130
Resistance to:			
- diluted acids	very good	very good	good
- diluted alkalis	good	good	good
- oxidizers	very good	very good	good
- organic solvents	very good	very good	good
Regeneration (permitted three times)	squeezing	squeezing	squeezing

Effectiveness of three variants of the proposed filter media

Productivity per day, l/m^2	Selectivity, %	Average pore diameter, Å	Porosity, %
600	80	<50	75
350	90	<50	75
250	95	<50	75
150	97.5	<50	75

The change in the bulk density of the material, which can easily be realized, leads to a change of the filter characteristics, efficiency and permeability of the filter media and can be set depending on the requirements of a given workplace.

Conclusions

Sorption barrier is created from waste fibers from the textile industry and has proven its effectiveness in the treatment of wastewater from oil and petroleum products.

The developed filter body can be installed in systems at the outlet of the water purification systems in petrol stations and in enterprises of oil industry.

By changing the number of layers used as a filler, water purification from oil products with different dispersity is implemented in a wide range of concentrations.

The total recovery rate can reach 98%.

THANK YOU FOR YOUR ATTENTION !

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