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Investigation the possibility of using non-woven materials from recycled fibers for open oil spills clean up

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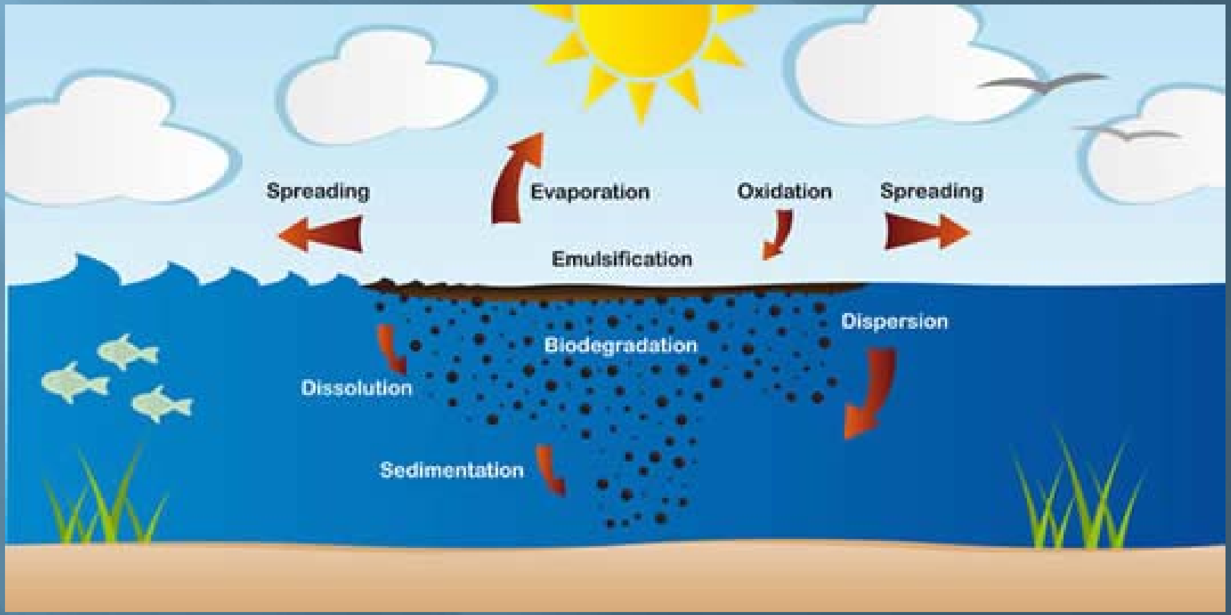
- hydrocarbons come in the aquatic environment from a variety of natural and artificial sources;

- maritime transport - performance of standard operations, and smaller part of incidents;

- oil disperses rapidly over a huge area with large differences in thickness of the floating layer in a short time;

- impedes the use of any techniques for dealing with spills.

- atmospheric destruction of oil - physical and chemical changes;
- performed under the action of natural forces - evaporation, dispersing, dissolving and precipitation and leads to the disappearance of oil from the water surface;
- water-oil emulsion - increase its viscosity, as the oil absorbs water up to four times its weight and promotes its resistance.



- oil film - breaks the exchange of energy between the atmosphere and the seas;
- low surface tension, low gas permeability and other negative qualities adversely affect the water physical and chemical conditions;
- leading to flora and fauna destruction in the sea basin, contamination animals with carcinogenic hydrocarbons that subsequently fall into human body.

Methods for cleaning up oil spills

Collection and recovery - long floating plastic or rubber enclosures (booms).

Sorbents

- hydrophobic and oleophilic,
- high degree of absorption and retention for a long period of time on the surface of the water,
- allow the extraction, reuse or recycle of absorbed oil

Recycling of textile waste

- Recovery and recycling of textiles - of great benefit for the economy and for the environment ;

- textile materials are a problem for landfills - synthetic fibers, degrade slowly and woolen during decomposition produce methane, which is one of the main culprits for the global warming;

- the need for new resources is reduced, pollution in the processing of new materials is avoided.

Materials and methods

non-woven materials obtained by needlepunching and stitch-bonding method

Materials	Type	Composition	Parameters
Material 1	stitch-bonding type Maliwatt	Wool 15% Cotton 18% Viscose 20% Polyester 17% PAN 30% Stitch fiber - polyester 100%	Step of stitching: 2.12 cm Length of thread in 1 cm: 3.74 cm Number of stitches in 1 cm: 3.2
Material 2	stitch-bonding type Maliwatt	Wool 5% Cotton 20% Viscose 17% Polyester 23% PAN 35% Stitch fiber - polyester 100%	Step of stitching: 0.7 cm Length of thread in 1 cm: 3.26 cm Number of stitches in 1 cm: 3
Material 3	needle punched	Wool 20% Cotton 20% Viscose 20% Polyester 20% PAN 15% Polyamide 5%	Frequency of needle-punching: 500 min^{-1} Depth of needle-punching: 12 mm Projection density: 15 needles/cm
Material 4	needle punched	100% recovered wool	Frequency of needle-punching: 800 min^{-1} Depth of needle-punching: 10 mm Projection density: 50 needles/cm

Material 1

Material 2

Material 4

Material 3

- seawater - from the Black Sea in the Bourgas area;

- two types of oil - mineral motor oil OMV Austroil SAE 15W/40 and waste motor oil collected from oil change workshop;

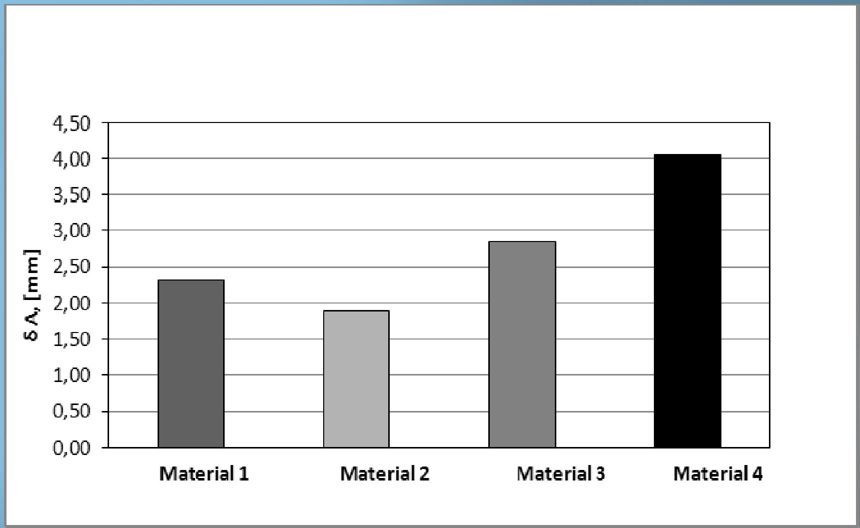
- developed methodology in a laboratory using different amounts of pure mineral and waste oil in static conditions and agitation and residence time of the samples in the suspension from 10 to 30 min suspension used -100 ml seawater and 2 ml oil;

- degree of sinking - determined after a period of 48 hours;

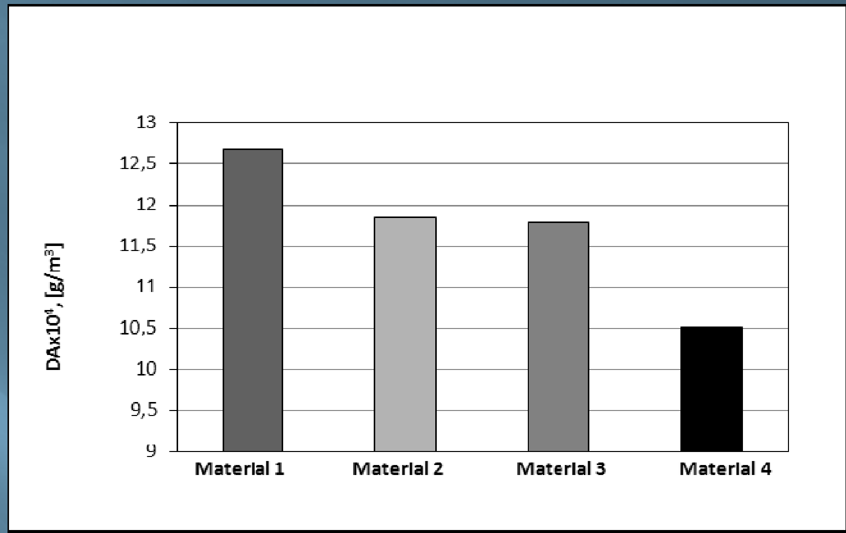
- characterized materials - by determining the thickness, area and volume weight, air permeability;

- retention and extraction of oil from the suspension - determined by weight after drying 4 hours at 105^{o} C with blasting.

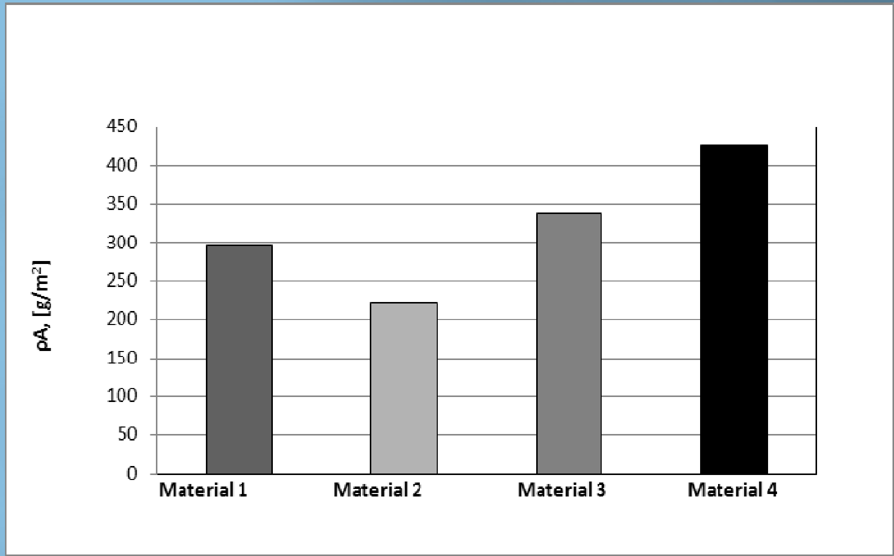
Results and discussion



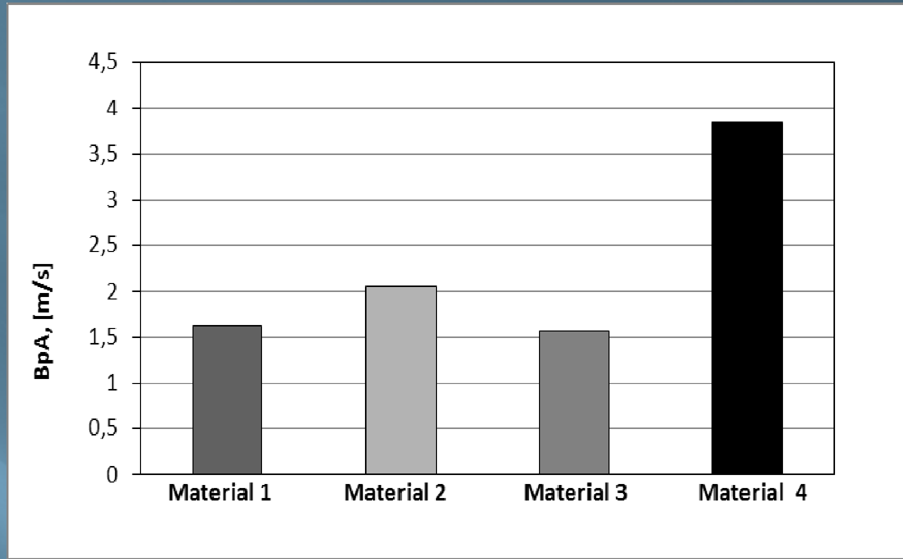
Thickness of used fibrous sorbents



Volume density

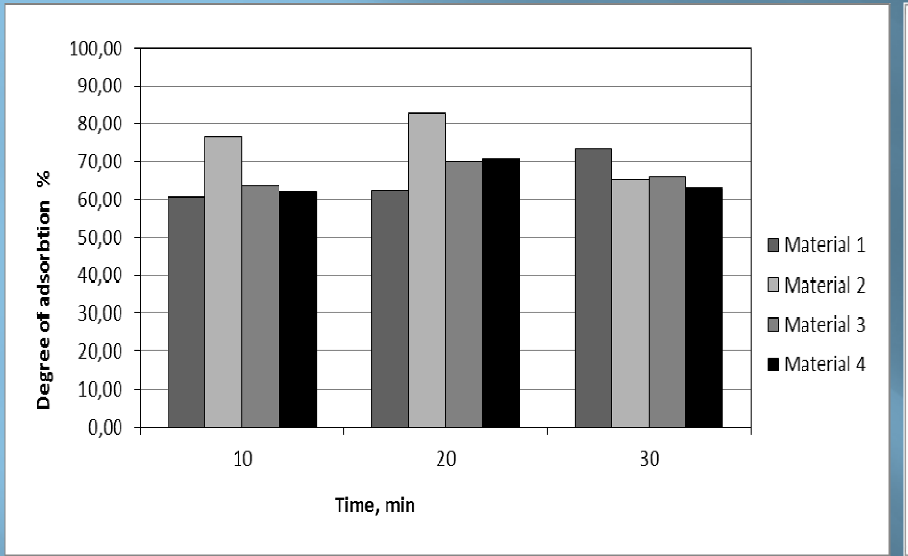


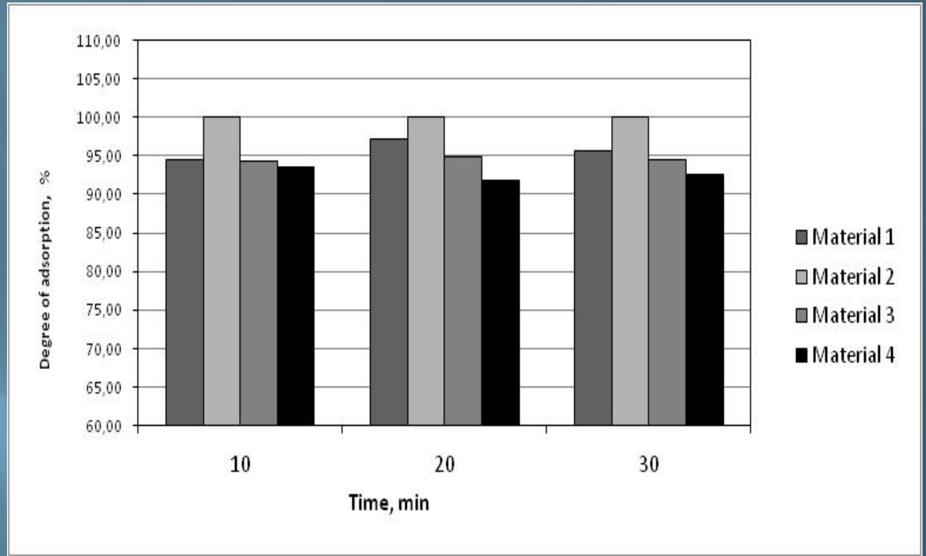
Mass per unit area



Coefficient of air permeability

Degree of adsorption of pure oil

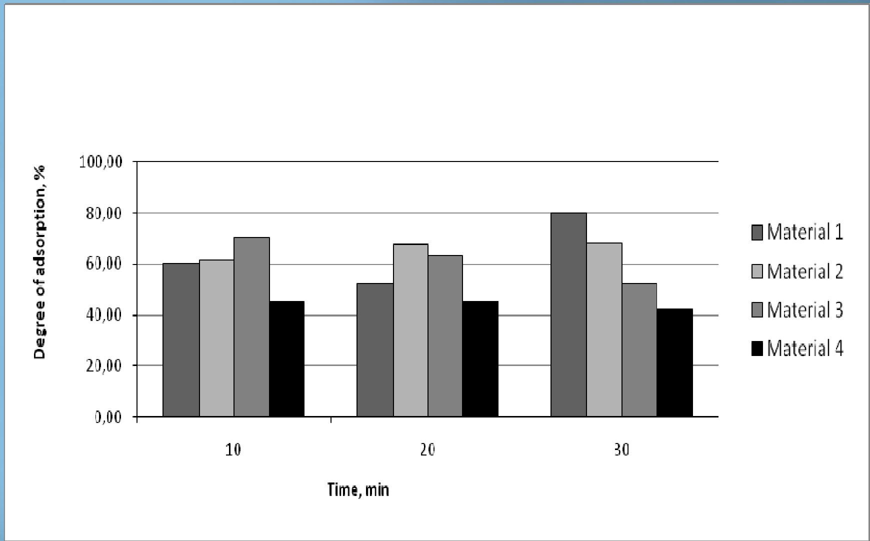


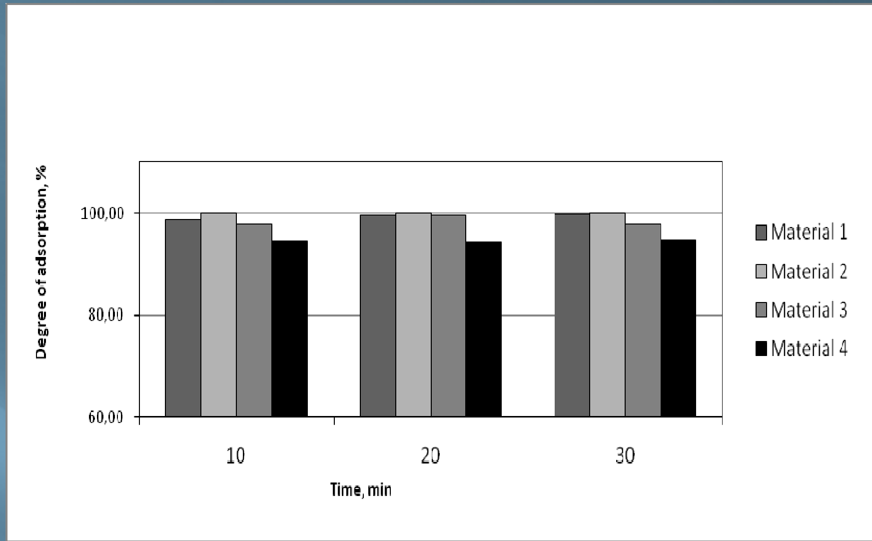


under agitation

under static conditions

Degree of adsorption of waste oil

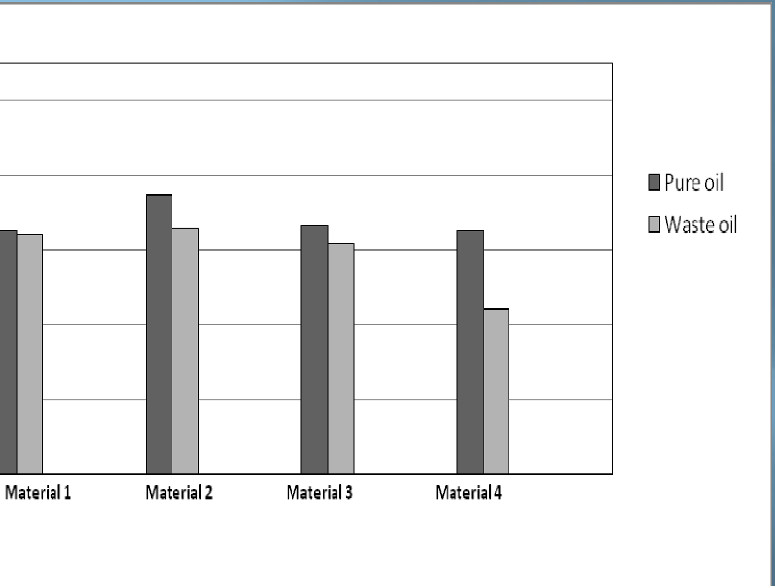


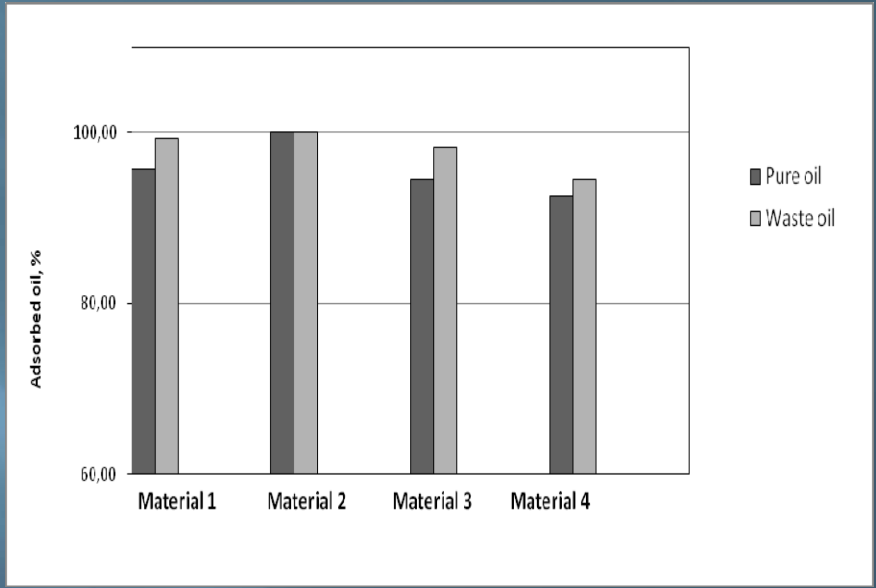


under agitation

under static conditions

Amount of adsorbed pollutant





under agitation

under static conditions

Results from combustion of waste samples

Material	Heat of combustion, kcal/kg	
	Unprocessed material	Processed material
Material 1	5754 ± 30	30 015± 30
Material 2	7399 ± 30	31 452± 30
Material 3	7260 ± 30	31 361± 30
Material 4	8122 ± 30	34 365± 30

Conclusions

As a result of tests carried out it has been found that the stitch-nded nonwoven materials have better ability to retain oil in mparison to needle-punched, because of the greater amount of free rous surface.

The use of waste fibers mixtures with a higher content of PAN is ore effective for absorbents of petroleum.

After use of the sorbents, their calorific value increases and erefore can be used as an energy source. But due to changing the de of the waste they have to be burned in special facilities, such as nnel kilns.

Depending on the fiber composition, textile sorbents sink after ferent periods of stay in the water due to the amount included drophilic fibers, but these studies continue in order to provide escription for the way and time of use of non-woven blankets from generated fibers.

THANK YOU FOR YOUR ATTENTION !

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