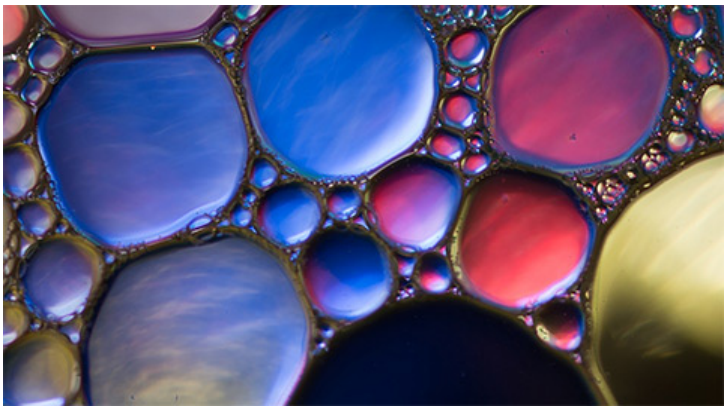
“Gluttonous” bacteria to clean up oily water effluents

A research team of lecturers and graduate students of Siberian Federal University has proposed a new solution to the problem of cleaning oily water of industrial enterprises, which envisages the formation of recycling water use and excluding the permeation of wastewater into natural water bodies. Cleaning is proposed to be carried out using a special sorbent, which includes immobilized bacteria capable of “digesting” the components of petroleum products.



“It is no secret that the technical wastewater treatment systems of many industrial enterprises, including the oil refineries, need to be improved. Now the oil traps installed at the enterprises, designed to separate and retain hazardous pollutants, work on average at 30% of the declared efficiency, and many toxicants leak into the environment, causing significant environmental damage. As for petroleum products, then the most important task was to identify the substances included in this vast group of pollutants. By means of physical and chemical analysis, we decided to compile a “dossier” on oil products in effluents from various enterprises and to select sorbents that would capture even those toxicants that had not sunk into the traps before,” said **Olga Dubrovskaya**, associate professor of the Department of Engineering Systems of Buildings and Structures of Siberian Federal University.

The team investigated wash water of the heat-power equipment of Krasnoyarsk CHPP-2, one of the largest heat and power plants in Siberia. The researchers have classified the main group of pollutants (organosilicon oils) and broke long polymer chains into short fragments using cavitation, in which a continuous stream of liquid is "split" by emerging bubbles or cavities filled with vapour. Further, the chopped short-chain contaminants were exposed to a special sorbent containing oil-oxidizing strain cultures.

“These strains are living bacteria capable of eating up petroleum products. Therefore, the working name of the sorbent СТК-А-БИО (STK-A-BIO) contains a reference to the biological component of our product. These bacteria are placed in special pores in the structure of the sorbent, and it is easy to immobilize them — to make them hibernate, however, when food comes in the process of absorption of petroleum products, these little helpers are activated and do their useful job: clean wastewater from substances hazardous to people, animals and plants,” said the researcher.

The existing counterparts are Unisorb-Bio, and S-Verad, but our sorbent has a different mineral-organic basis.

The new biosorbent is small granules that are easy to use at an industrial scale. An important nuance of its use is a large temperature range at which the sorbent works at its full capacity (bacteria lose activity at temperatures below -0.1°C, but at the same time the mineral-organic component works to extract and accumulate petroleum products, and a favourable temperature activates the bacteria which oxidate the pollutant). According to the developers, the main advantage of СТК-А-БИО is that the sorbent, in addition to physicochemical sorption, has the property of bio-oxidation due to the inclusion of bacteria in its

composition, and this is a different, qualitatively higher level of care for the environment.

The researchers noted that the sorbent had already passed semi-industrial tests at plants in the city of Kodinsk (Krasnoyarsk Territory). The sorbent is being developed jointly with the New Energy company, and the University has received an order from the STAB-Composition company, which is ready to engage in the large-scale production of this innovative product according to the technology developed at Siberian Federal University.

This work was carried out with the financial support of the Krasnoyarsk Regional Science Foundation in the framework of research project 2020021006020.

30 september 2020