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**Surface modification of post-consumer polyurethane foams with zinc rods grafting for oil spill sorption in seawater.**

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In recent decades, many efforts have been made to accelerate the transition to clean energy. However, there will still be significant dependence on oil for many decades to come. Extracting and transporting oil offshore can lead to oil spills in the sea. To remove it, skimmers, fire, and adsorption on porous materials are some of the techniques that have been used. Polyurethane foams (PU), for example, are highly porous polymeric structures found in domestic homes, especially in mattresses. After the end of their useful life, mattresses become waste. This work aims to modify this waste to make it able to remove another. To achieve this, new and post-consumer PU were grafted with (micro and nano) ZnO rods producing ZnO-N and ZnO-PC, respectively, aiming to apply them for oil recovery. The new foams were tested to verify if their condition could influence the sorption capacity. Unaltered foams (Un-N and Un-PC) were used in all steps for comparison purposes. SEM+EDS and Contact Angle were performed for characterization. Comparing Un-N and Un-PC to ZnO-N and ZnO-PC, respectively, the surfaces were changed from smooth to rough due to the presence of ZnO rods with well-defined shapes and dimensions ranging from nanometers to micrometres. C, N, and O together represented 97.82 and 99.05 %atoms of Un-N and Un-PC composition, respectively. In contrast, C, N, plus O represented only 55.56 and 29.36 %atoms for ZnO-N and ZnO-PC, respectively (while 44.43 and 70.64 %atoms for Zn). After grafting with ZnO, the contact angle increased from 90.1° (Un-N) to 124.6° (ZnO-N), and from 104.4° (Un-PC) to 121.3° (ZnO-PC). This was due to hydrophobization caused by ZnO rods. Three sorption tests were performed. In the first one, when only seawater was used, all foams showed statistically similar results, reaching maximum sorption of 7.65 ± 0.36 g/g (Un-N). In the second system, two oils were tested separately. For diesel oil (~4 cSt), all foams showed statistically similar results, reaching maximum sorption of 43.93 ± 0.94 g/g (Un-PC). However, when lubricating oil S46 (~46 cSt) was used, ZnO-N increased about 18x the sorption capacity compared to Un-N, and about 29x if ZnO-PC is compared to Un-PC (reaching up to 42.39 ± 0.92 g/g). The third sorption test was performed in a multicomponent system formed by seawater (92%):(8%) lubricating oil S46. While Un-PC was able to absorb 0.08 ± 0.00 g/g of water and 3.20 ± 0.12 g/g of oil, ZnO-PC absorbed 4.36 ± 0.13 g/g of water and 28.74 ± 0.32 g/g of oil. Although there was an increase in water sorption between Un-PC and ZnO-PC, the increase in oil sorption was much more significant (798% or 9x). The roughness caused by the ZnO rods on the polyurethane surface combined with the increase in intermolecular forces of Van der Waals type proved its strong influence in increasing the sorption capacity and its selectivity for oil over water. The results also showed that post-consumer foams might be viable for oil spill recovery.