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Magnetic nanocomposites filled with curaua for oil spill cleanup process

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Oil spill produces harmful effects on the environment, living organisms and economy. The oil cleanup process will be more effective if the sorbent material is having more bidegradabilty, uptake capability, hydrophobicity, reusability and cost effectiveness. Among these materials, the natural sorbents, such as straws and cotton, can be considered as eco-friend materials, due to their great availability in nature and low environmental impact. In this specific context, our group is focuses on the use of renewable resources that can be transformed into polymeric materials having good amount of biodegradability as well as oil absorptivity for oil spill cleanup applications 1,2. The present work was focused on the development of novel composites, derived from renewable resources such as cardanol and curaua fiber, which could be useful for oil absorbing applications. Cardanol-furfuraldehyde resins were reinforced with acetylated curaua fibers, prepared by in situ bulk polymerization. Magnetic nanoparticles were incorporated into the bioresin, allowing an easier oil spill cleanup. In addition, the curaua fibers were acetylated, pointing to promote the hydrophobicity of the fibers, increasing the oil absorbing capability of the composites. The obtained materials were characterized by FTIR, TGA and XRD analysis. In addition, magnetic force and oil removal capability tests were also performed. Nanocomposites, with and without the fibers, presented a good magnetic force allied to a considerable oil removal capability (ORC), which was improved by the incorporation of acetylated curaua fibers.

From the oil removal tests, it has been shown that all the resin compositions could sorb at least 10 g of the petroleum from the water. Resin without fibers could absorb (10.25±0.35) g/g oil, while composites containing 1, 5 and 9wt% of the fibers were able to sorb (10.93±0.24) g/g, (12.65±0.21) g/g and (12.38±0.18) g/g of petroleum, respectively. After the oil removal tests, gravimetric experiments shown that 90% of the sorbent was recovered from the oil by filtering process. Recovered material was reused in further cleanup experiments. Tests were performed using the material containing 9wt% of the fibers . In the first, second and third reuse cycles, this material was able to remove (12.65±0.21) g/g, (11.25±0.56) g/g ad (10.80±0.54) g/g of the Oil 1 from the water, respectively. Therefore, results allow to conclude that the sorbent can be reused in oil spill cleanup applications.

Obtained results allow us to conclude that the acetylation of curaua fiber produced more hydrophobic materials useful for oil absorption applications. In addition, oil removal tests showed that the resins containing curaua fibers were able to absorb 25% more oil than the resins without fibers, which clearly depicts the importance of the curaua fiber as a substrate for oil removal applications.

Biography

Fernando Gomes is Ph.D. in Polymer Science and Technology (IMA/UFRJ). He is Assistant Professor at the Macromolecules Institute (IMA/UFRJ), Scientist of CNPq and Young Scientist of the State of Rio de Janeiro (FAPERJ-2012). He works mainly with polymeric nanocomposites from renewable resources in three main lines: (i) environmental remediation, coordinating research projects focused on the use of renewable resources for the removal of oil spills; (ii) human health, coordinating projects that seek the kinetic and spatial control of drug release process; and (iii) sensors, in which coordinates projects that seek to obtain conductive natural fibers useful in sensors for smart devices.

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