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參展科別	化學
作品名稱	Sustainable Graphene Oxide Support for Ruthenium Catalysts to Improve the Efficiency of the Hydrodesulfurization of Thiophenes
得獎獎項	四等獎

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Abstract

Saudi Arabia is the largest oil exporter in the world. 64,000,000 tons of sulfur oxides are produced every year through the combustion of organic sulfur compounds in the oil industry. This leads to several environmentally serious problems, including air pollution. This research provides a novel strategy to utilize natural-based Graphene Oxide (GO) as a support for ruthenium (Ru/GO) to functionalize as a green catalyst for hydrodesulfurization. Physical activation of camel bone samples was carried out by carbonizing them at 500ºC to produce camel bone charcoal. Modified hammer's method was employed for GO production, followed by doping of ruthenium in a simple synthesis step.

The prepared catalyst has been characterized by XRD, SEM and EDX techniques. Thiophene and 3-methylthiophene were used as model compounds in the hydrodesulfurization process. The catalytic reactions were carried out at atmospheric pressure in a continuous up-flow fixed-bed quartz reactor. The composition of the sulfur containing gaseous products was analyzed by gas chromatography. The product distribution achieved for thiophene was 3-6% butadiene and 76-77% butane. And for 3-methylthiophene, it was 32.3% of pentaned 1-pentene and 2-pentene and the selectivity percentage was 45%.

Ru/GO has been found to be an excellent catalyst of thiophene and 3-methylthiophene hydrodesulfurization and is a considerable improvement when compared to the commercially available catalysts. The prepared catalyst shall potentially lead to the reduction of sulfur pollution in the future. The positive effect on the environment could be substantial.

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Oil refining is the major industry in Saudi Arabia. The by-product of oil refining is sulfur-containing hydrocarbons and it would be ideal to create an efficient catalyst to carry out desulfurization of these species, in particular thiophenes. The whole project used local materials (camel bones) to solve local problems and is highly encouraged. Using graphene oxide produced from camel bones as/solid support, ruthenium composite catalysts were synthesized and then characterized by a wide variety of techniques. The judges would remind the student to follow safety protocols (i.e. wearing goggles) to ensure the safety when conducting experiments. In general, the research idea and design is good and the results are promising in the oil refining industry. It is also practical and has potential to solve real problem.