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Desulfurization of waste tire pyrolytic oil (TPO) using photodegradation and adsorption techniques

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The nature of tires makes them extremely challenging to recycle due to the available chemically cross-linked polymer and therefore, they are neither fusible nor soluble and consequently cannot be remolded into other shapes without serious degradation. Open dumping of tires pollutes the soil, contaminates underground water and provides ideal breeding grounds for disease carrying vermins. The thermal decomposition of tires by pyrolysis produces char, gases and oil. The composition of oils derived from waste tires has common properties to commercial diesel fuel. The problem associated with the light oil derived from pyrolysis of waste tires is that it has a high sulfur content (>1.0 weight percentage) and therefore emits harmful sulfur oxide (SOx) gases to the atmosphere when combusted in diesel engines. Desulfurization of TPO is necessary due to the increasing stringent environmental regulations worldwide. Hydrodesulfurization (HDS) is the commonly practiced technique for the removal of sulfur species in liquid hydrocarbons. However the HDS technique fails in the presence of complex sulfur species such as Dibenzothiopene (DBT) present in TPO. This study aims to investigate the viability of photodegradation (Photocatalytic oxidative desulphurization) and adsorptive desulphurization technologies for efficient removal of complex and non-complex sulfur species in TPO. This study focuses on optimizing the cleaning (removal of impurities and asphaltenes) process by varying process parameters; temperature, stirring speed, acid/oil ratio and time. The treated TPO will then be sent for vacuum distillation to attain the desired diesel like fuel. The effect of temperature, pressure and time will be determined for vacuum distillation of both raw TPO and the acid treated oil for comparison purposes. Polycyclic sulfides present in the distilled (diesel like) light oil will be oxidized dominantly to the corresponding sulfoxides and sulfone via a photo-catalyzed system using TiO2 as a catalyst and hydrogen peroxide as an oxidizing agent and finally acetonitrile will be used as an extraction solvent. Adsorptive desulfurization will be used to adsorb traces of sulfurous compounds which remained during photocatalytic desulfurization step. This desulfurization convoy is expected to give high desulfurization efficiency with reasonable oil recovery.

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Air pollution and asthma in Kuwait

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In this study, we have investigated the link between weather parameters, airborne pollens, air pollutants and the number of asthmatic patient visits in Al Rasheed Allergy Center, Kuwait during a full annual cycle. The pattern of the pollen counts graph exhibits a consistent annual cycle. A good correlation is obtained between airborne pollens and asthmatic patients in 2012. We identify 35 days with the number of asthma visit patients exceed 188. The Chree's method of superposed epoch has been applied to study the behavior of weather parameters and air pollutants on these days with respect to the rest of the days in 2012. The wind speed increases to 3.9±0.1 m/s one day before the increase in the numbers of asthmatic patients. This increase causes a spread in the air pollens that directly increase the number of patients. The daily average values of dew point and relative humidity increase with the number of asthmatic patients while the visibility decreases. This may trigger asthmatic symptoms. We find no link between air pollutants and the number of asthmatic patients. The major dust storms of 2012 have no effect on the number of asthmatic patients as they consist mainly of coarse particles.

Notes:

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