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Production of TDAE grade environmental friendly rubber process oils from lube extracts through new process scheme

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Abstract

Rubber process oils (RPO) are utilized as raw materials in the manufacture of tire compounds and oil extended natural or synthetic rubbers. Depending upon the nature of hydrocarbons present in the RPOs, they are classified into aromatic, naphthenic and parraffinic oils. Refineries produce aromatic type process oils called Distillate Aromatic Extract (DAE) which has higher market demand. But the disadvantage with DAE type oils is its higher content of Poly Aromatic Hydrocarbons (PAH), which are carcinogenic and their use is limited in European Union based on legislations. Similar legislations are expected to follow in several countries to limit the use of PAH containing aromatic-rich lube extracts. The demand for such low PAH RPO such as Treated Residue Aromatic Extract (TRAE) and Treated Distillate Aromatic Extract (TDAE) is going to increase as per the market projections. Thus, it is imperative for refiners to develop processes to produce low PAH RPO from existing refinery streams such as lube aromatic extracts/ distillates.

Due to the implementation of MARPOL specifications, several fuel oil grade streams are available in refineries for upgradation which include lube extracts and residues obtained from FCC/Solvent Deasphalting/Visbreaking processes. These low value streams with higher amounts of aromatics are currently used as blending stocks for fuel oil production and could be a potential feed stock for the production of environment friendly RPO. The limiting factor is their higher PAH contents which limits their use due to EU directives.

Applications

There is no existing process in India for production of TDAE grade RPO. New HPCL R&D has developed a process based on re-extraction of lube oil extracts such as 500 N/ DAO extracts using a novel solvent extraction process utilizing selective solvents to extract PAH containing molecules and produce environment friendly RPO with lower PAH content (<3 wt%). The

process was developed based on successful lab results using selective solvent systems, optimized process conditions and solvent compositions.

Results and Conclusions

Based on R&D testing, commercial trials were carried out at Hindustan Petroleum Corporation Limited (HPCL) Mumbai refinery's solvent extraction unit for producing low PAH RPO. Commercial plant trials showed that the reduction of Polycyclic aromatic content by 2-3 wt% in the raffinate stream which is used to produce low PAH RPO. Potential economic benefit of the process is estimated to be about Rs. 90 Crores/annum.

Technical Contributions

HPGRDC has developed two novel processes for production of environment friendly rubber process oils based PCA selective system. First process was implemented at HPCL MR and resulted in economic benefit is Rs. 10 Cr. This process was implemented since 2020. New process of HP-TDAE grade RPO process is developed based novel solvent system and process. BDEP and FEED activities completed for HP-TDAE process. Pre-project activities at HPCL MR is in progress for setting up of demonstration plant capacity 48 KTPA. Expected economic benefit is Rs. 80 Cr per annum.