Co-processing of wood and wheat straw derived pyrolysis oils with FCC feed—Product distribution and effect of deoxygenation

The behavior of bio-oils when co-processed with conventional fossil feed in a fluid catalytic cracking (FCC) unit is suitably tested using a microactivity testing unit (MAT). In the present study, non-catalytic fast pyrolysis oils originating from wood and wheat straw were co-processed in a MAT at a 20/80 weight blend (bio-oil/FCC feed). In addition, bio-oil obtained from deoxygenating the straw derived vapors over a steamed HZSM-5/Al₂O₃ extrudate catalyst was tested. The bio-oils were characterized for elemental composition and moisture content to calculate energy recoveries, amounting to 35% and 30% for the non-catalytically obtained wood and straw oils, while it was 19% for the partly deoxygenated straw oil. Wood oil showed higher acidity (61mg KOH/g) and molar O/C ratio (0.35) compared to straw oil (54mg KOH/g and O/C=0.24). The acidity and O/C ratio was reduced for the straw-derived bio-oil from catalytic vapor treatment (3mg KOH/g, O/C=0.08). At constant conversion (77.5%) at the MAT, the wood pyrolysis oil showed a product distribution quite similar to the reference oil while the wheat straw pyrolysis oil gave a 1.6% points higher coke yield and a 1.2% points lower liquid petroleum gas (LPG) yield. For the catalytically treated wheat straw pyrolysis oil, an even higher coke yield (2.6% points) and 1.9% points lower LPG yield resulted. The observations are attributed to the higher content of aromatics, phenolics, and nitrogen containing compounds of the catalytically upgraded straw fast pyrolysis oil.