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TWO STAGE CATALYTIC CRACKING OF HDPE AND PP IN THE PRESENCE OF NATURAL AND SYNTHETIC ZEOLITES

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Plastics are dominant in the municipal waste. Polyalkenes polyethylene and polypropylene represent the main types of plastic waste. Therefore their treatment by thermal or catalytic process seems to be very promising with goal to obtain valuable petrochemicals or fuels.

Experimental

Materials

HDPE and PP
(in the form of pellets)

Clinoptilolite
(modified by 0.1M HCl solution)

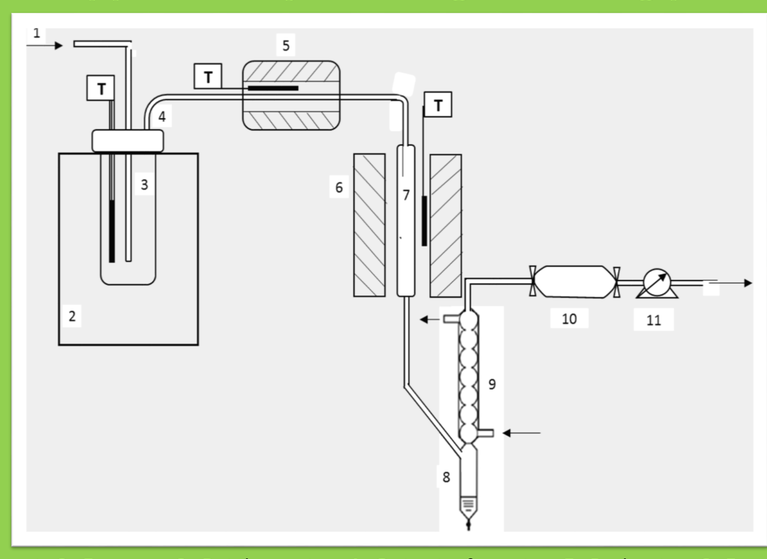
HZSM -5
(extrudates of alumina and HZSM-5 in ratio 1:1)

Reaction conditions

All experiments (thermal and catalytic cracking) were carried out at the same experimental conditions:

- temperature of 450°C
- nitrogen flow of 60 mg/min
- mass ratio of feedstock/catalyst (7:1)

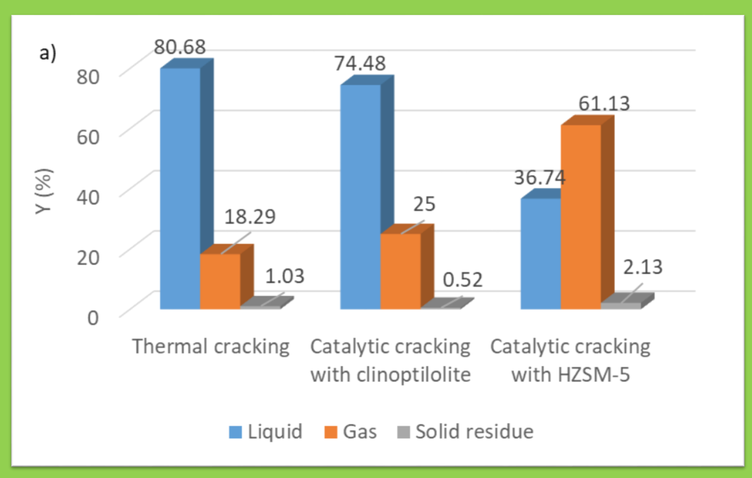
Apparatus of two stage cracking process



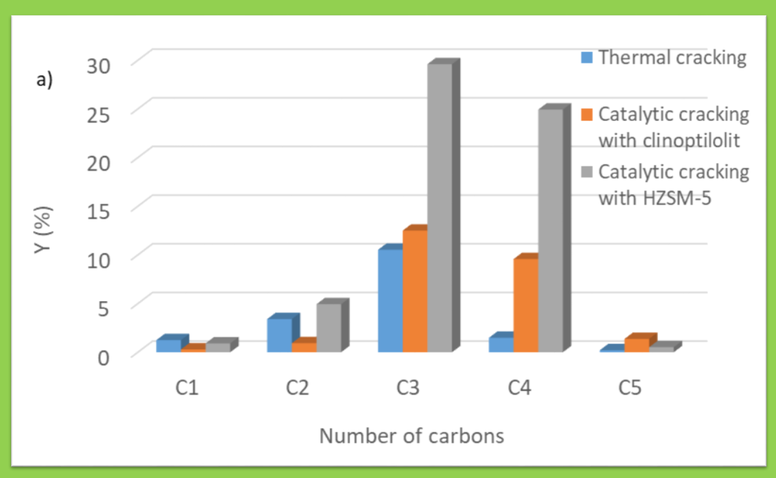
1. Nitrogen input, 2. Furnace, 3. Batch reactor, 4. Output of reactor, 5. Preheater, 6. Furnace, 7. Catalytic reactor, 8. Phase separator, 9. Liebig cooler, 10. Gas sampler, 11. Bubble flow meter, T- thermocouples

Results

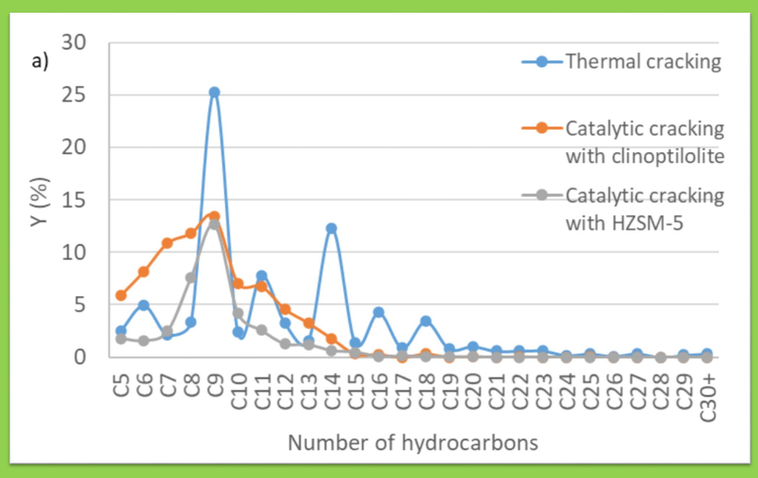
Material balance

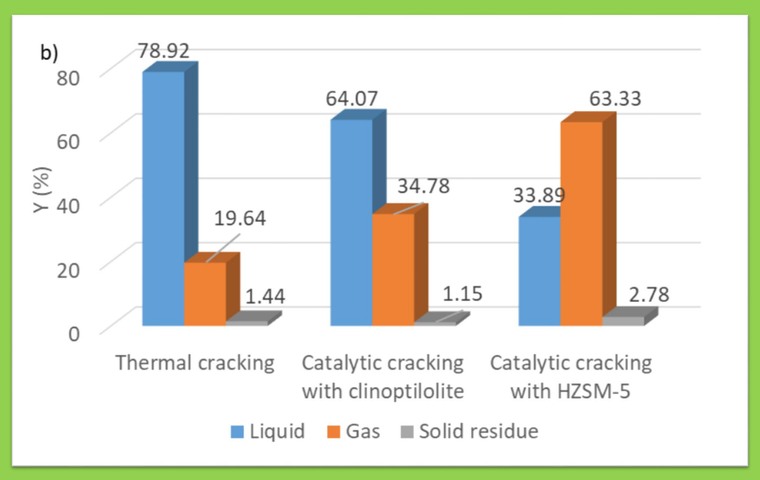


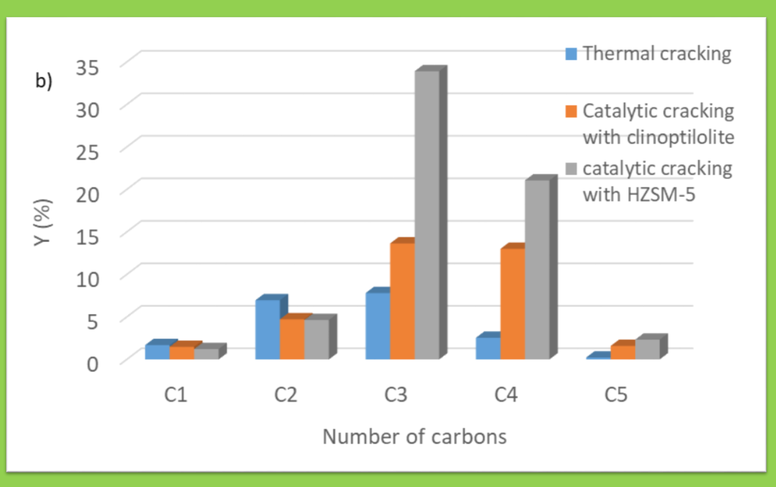
Gaseous hydrocarbons

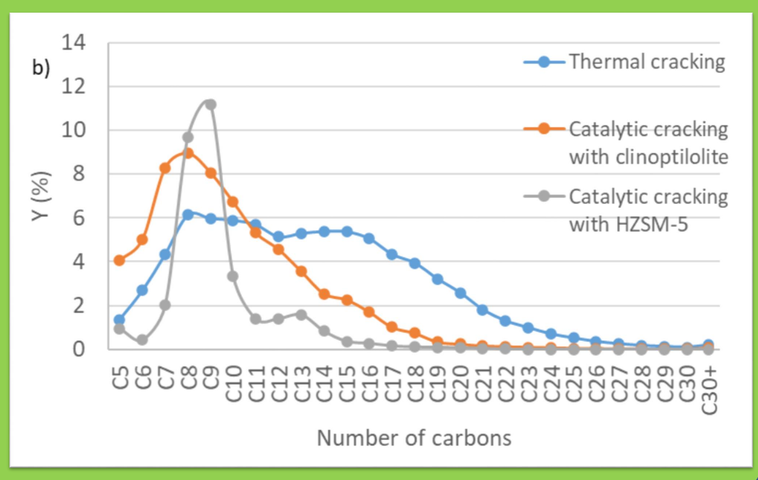


Liquid hydrocarbons









Yields of hydrocarbons resp. fractions for thermal and catalytic cracking in the presence of clinoptilolite (semibatch reactor) or HZSM-5 (flow reactor) for a) PP and b) HDPE

Conclusion

Synthetic zeolite HZSM-5 has significant influence on the formation and composition of gaseous fraction for both type of polymers. It is manifested by high yields of the gas fraction and increased formation of C3 and C4 hydrocarbons. Yield of gas fraction for PP is 3.3 times higher and for HDPE 3.2 times higher in comparison with gas yield from thermal cracking.

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