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Continuous production of biodiesel from rapeseed oil by ultrasonic assist transesterification in supercritical ethanol

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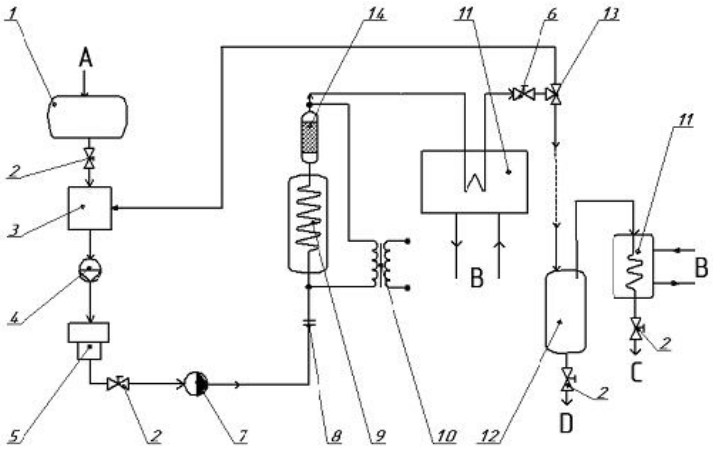
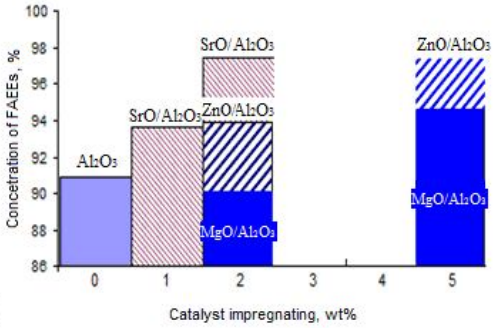
Graphical abstract



Schematic diagram of the pilot experimental setup with continuous flow-type reactor for biodiesel production: 1 - Tank for alcohol; 2 - Valve; 3 - Mechanical Mixer, 4 - Gear Pump; 5 - Ultrasonic emulsifier, 6 - High pressure valve; 7 – Pump for delivering, 8 - Insulator, 9 – Continuous flow-type reactor, 10 - Step-down transformer, 11 – Condenser, 12 - Thin film evaporator, 13 - Tapping, 14 - Catalytic reactor with fixed bed catalyst. A – ethanol+oil mixture, B – cooling water, C – unreacted ethanol, D – biodiesel.



Highlights

- High yield (97.45 %) of ethyl esters are obtained by using ZnO/Al_2O_3 (5 wt %) under SCF conditions (T=623 K, P =30 MPa, molar ratio ethanol/oil -12:1).
- A comparable yield (97.46 %) are obtained under the same conditions with the SrO/Al_2O_3 (2 wt %) catalyst.
- SrO/Al_2O_3 was found to be the best candidate for biodiesel production.

ABSTRACT

In Europe, rapeseed is a renewable raw material which has been widely used for the production of biodiesel by various processes. The transesterification reaction of rapeseed oil with ethanol to biodiesel in supercritical fluid conditions was investigated using several