

ESTERIFICATION OF FREE FATTY ACID
IN USED COOKING OIL USING
SULPHONATED HYPERCROSSLINKED
EXCHANGE RESIN AS CATALYST

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NURUL ASMAWATI BT ROSLAN

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LIST OF SYMBOLS

| | |
|----------------------|--|
| N_{acid} | Acid number |
| A | Volume of KOH, volume of the titration solvent |
| B | Volume corresponding to the blank titration |
| W | Weight of the sample |
| M | Concentration of KOH |
| N | Normality of the titration solution |
| AR_i | Area of the i^{th} component |
| A_i | Area of the i^{th} component |
| A_{is} | Area of the internal standard |
| CR_i | Concentration ratio of the i^{th} component |
| C_i | Concentration of the i^{th} component |
| C_{is} | Concentration of the internal standard |
| RF_i | Response factor of the i^{th} component |
| AR_i | Area ratio of the i^{th} component |
| CR_i | Concentration ratio of the i^{th} component |
| C_{ij} | Concentration ratio of the i^{th} component of j^{th} sample |
| AR_{ij} | Area ratio of the i^{th} component of the sample j^{th} |
| RF_i | Response factor of the i^{th} component |
| V | Volume of water |
| m_{H_2O} | Mass of water |
| ρ_{H_2O} | Density of water |
| ρ_L | Density of liquid sample |
| m_L | Mass of liquid sample |
| m_c | Mass of catalyst |
| v | Volume of the sample |
| C_{NaOH} | Concentration of NaOH |
| C_{HCl} | Concentration of HCl |
| V_{HCl} | Volume of HCl |
| V_{NaOH} | Volume of NaOH |
| $C_{NaOH\ adsorbed}$ | Concentration of NaOH adsorbed |

| | |
|---------------------|-------------------------------------|
| $C_{NaOH\ initial}$ | Initial concentration of NaOH |
| $C_{NaOH\ final}$ | Final concentration of NaOH |
| q_{NaOH} | Sodium adsorption capacity |
| $V_{initial}$ | Initial volume |
| C_{FFA} | Conversion of FFA |
| C_{FO} | Initial concentration of FFA |
| C_F | Concentration of FFA at any time |
| MW_{tri} | Molecular weight of oil |
| MW_{FFA} | Molecular weight of free fatty acid |
| MW_{water} | Molecular weight of water |

LIST OF ABBREVIATIONS

| | |
|-------|---|
| BET | Brunauer-Emmelt-Teller |
| BSI | British Standard Institution |
| FAME | Fatty acid methyl ester |
| FESEM | Field emission scanning electron microscopy |
| FESEM | Field emission gun-scanning electron microscope |
| EDX | Energy dispersion X-ray |
| FFA | Free fatty acids |
| FID | Flame ionisation detector |
| FTIR | Fourier transform-infra red |
| GC-MS | Gas chromatography-mass spectrometry |
| IEC | Ion exchange capacity |
| IER | Ion exchange resin |
| KBr | Potassium bromide |
| NA | Not available |
| NAD | Non-aqueous dispersion |
| OVAAT | One variable at a time |
| PP | Precipitation polymerisation |
| PSD | Particle size distribution |
| RF | Response factor |
| RPM | Revolution per minute |
| SEM | Scanning electron microscopy |
| SHER | Sulphonated hypercrosslinked exchange resin |
| SPE | Solid phase extraction |
| SUCO | Simulated used cooking oil |
| TGA | Thermogravimetric |
| UCO | Used Cooking Oil |
| XRF | X-ray Fluorescence |