

DEVELOPMENT OF TERNARY PHASE DIAGRAM: OPTICAL AND MECHANICAL CHARACTERIZATION OF WATER/TAPIOCA STARCH/TRITON X-100 LIQUID CRYSTAL

ABSTRACT

Triangle Ternary Phase Diagram can be classified as a diagram that represents the equilibrium between the various liquid crystal (LC) phases that are formed between three components. The optical and mechanical properties of ternary mixtures of Water/Tapioca Starch/Triton X-100 were studied by Polarizing Optical Microscope (POM), Simultaneous to Wide Angle X-Ray Scattering (SWAXS) and Rheometer. POM and SWAXS were used for phase identification and structure characterization. Rheometer was used to investigate the rheological properties of LC. Three different temperatures were used in this study: 15°C, 25°C and 45°C. Several texture and optical pattern were examined under the POM. The ternary phase diagram systems obtained in this work tend to form different LC phases with the increase of concentration and temperature of the mixtures. Two types of LC were formed namely Lyotropic (LLC) and Thermotropic (TLC). Lamellar and micelle phase were formed in the LLC while nematic phase was formed in TLC. Optical investigation was done by examining the change of phase in the LC according to the change of temperature and amphiphile concentration. The phase transitions of TLC was found to depend on the temperature, while for the LLC, it depends on both the temperature and concentration. SWAXS was studied with the finding of lattice spacing, d value of LC: 96.61 Angstrom for the sample 40:30:30 of Water/Tapioca Starch/Triton X-100 at 25°C as an example. The values of d are in agreement with the Bragg's Law where the values of d increases with increasing temperature. Furthermore, the viscosity-shear rate-shear stress plot was discussed based to the rheological properties.

**PEMBANGUNAN GAMBARAJAH SEGITIGA FASA: PENCIRIAN SIFAT
OPTIK DAN MEKANIKAL BAGI AIR/KANJI UBI KAYU/TRITON X-100
CECAIR KRISTAL**

ABSTRAK

Rajah segitiga fasa boleh diklasifikasikan sebagai rajah yang memperlihatkan perbezaan di antara fasa Cecair Kristal (LC) yang terbentuk hasil daripada campuran tiga bahan berbeza. Pencirian sifat optik dan mekanikal bagi campuran bahan Air/Kanji Ubi Kayu/Triton X-100 dikaji dengan menggunakan *Polarizing Optical Microscope (POM)*, *Simultaneous to Wide Angle X-Ray Scattering, (SWAXS)* dan *Rheometer*. *POM* dan *SWAXS* bertujuan mengenalpasti fasa dan pencirian struktur fasa. *Rheometer* bertujuan mengkaji sifat reologi oleh LC. Tiga suhu yang berbeza digunakan dalam kajian ini: 15°C, 25°C dan 45°C. Pelbagai bentuk dan corak diuji dengan menggunakan *POM*. Rajah segitiga fasa akan menunjukkan perbezaan antara fasa LC bergantung kepada peningkatan kepekatan dan suhu campuran. Dua jenis LC yang terbentuk dinamakan *Lyotropik (LLC)* dan *Termotropik (TLC)*. Fasa *lamellar* dan *micelle* dihasilkan pada LLC manakala bagi *nematic* adalah TLC. Pencirian optik dilakukan dengan berpandukan kepada perubahan fasa LC bergantung kepada perubahan suhu dan kepekatan *amphiphile*. Perubahan fasa bagi TLC bergantung kepada suhu manakala bagi LLC bergantung kepada suhu dan kepekatan. Kajian SWAXS melalui pencarian nilai bagi jarak lattice, d oleh fasa yang terhasil: Menunjukkan nilai jarak lattice dan pencirian reologi LC ialah 96.61 Angstrom oleh sampel 40:30:30 Air/Kanji Ubi Kayu/Triton X-100 pada suhu 25°C. Nilai d dapat dikaitkan dikaitkan dengan Hukum Bragg di mana d bertambah dengan suhu. Selain itu, graf kelikatan-kadar ricih-kadar tekanan turut dibincangkan di dalam pencirian reologi.