

UNIVERSITI TEKNOLOGI MARA

**STUDY OF THERMOTROPIC AND
LYOTROPIC BEHAVIOURS OF
GLYCOLIPIDS MIXTURE**

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ABSTRACT

In recent years, synthetic glycolipid biosurfactants received great attention due to their non-ionic and biodegradable properties. In addition, the synthetic glycosides shown surface active properties which make them useful for fundamental investigations and industrial applications. Glycolipids are produced by combining carbohydrates with lipids through covalent bond. They consist of a sugar head group and an alkyl chain attached to an anomeric carbon via the glycosidic bond. Technical grade glycolipids based on alcohol mixtures from reduced palm kernel oil were investigated to explore their application as surfactant and drug carrier. The palm kernel oil-based glycosides (ManPKO) and pure mannoside compounds, ManC12 and ManC18:1 were synthesized by adopting Fischer glycosylation method with minor modification. Thermotropic and lyotropic behaviours of ManPKO was studied to explore the mixture effect and compared with pure glycosides i.e. ManC12 and ManC18:1. Their thermal behaviours were determined by differential scanning calorimetry (DSC). Their liquid crystalline phases were characterized using optical polarizing microscopy (OPM) and small-angle X-ray scattering (SAXS). In addition, their solution properties were also investigated by tensiometer. The isotropic temperature for these mannosides (ManPKO, ManC12 and ManC18:1) were at 147°C, 162°C and 140°C, respectively. The phase texture observed under Optical Polarizing Microscope in thermotropic study for all mannosides is smectic A upon cooling followed by birefringent battonet texture. For lyotropic experiment, it was shown that lamellar phase was observed. The birefringency of sample slowly reduced upon addition of water for all mannosides. The SAXS investigation also confirmed the formation of smectic A and lamellar phases in thermotropic and lyotropic condition, respectively. Based on finding, palm kernel oil-based mannosides behave similar like a pure mannosides even it consists approximately 15% of unsaturated component. In addition, the formation of stable lamellar phase in hydrated condition makes ManPKO ideal candidates as a new drug carrier system.

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CHAPTER ONE

INTRODUCTION

1.1 Background Study

Carbohydrates composed of carbon, hydrogen, and oxygen atoms that represented by the general formula $C_n(H_2O)_n$, where n is a whole number. Carbohydrates are the most abundant class of organic compounds found in living organism. The carbohydrates are a major source of metabolic energy for plants and animals. Figure 1.1 below shows the type of food that rich of carbohydrates source.

Carbohydrates can be divided into three major classes which are monosaccharide, disaccharide and polysaccharides as summarize in Figure 1.2. The word monosaccharide is derived from mono, meaning "one", and saccharide, meaning "sugar". The common monosaccharide are glucose, fructose, and galactose. While, disaccharide means "two sugars" that are commonly found in nature as sucrose, lactose and maltose. They are formed by a condensation reaction where one molecule of water condenses or is released during the joining of two monosaccharides. The type of bond that is formed between the two sugars is called glycosidic bond. Whereas carbohydrates



Figure 1.1 Type of Daily Food that Rich of Carbohydrates Content (Shukla, 2015).