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1. Introduction

DSC is a versatile technique and has been used for decades to study hydrated phospholipid membranes [1-4]. It can even be used to analyze whole cell samples [5]. For pure lipids, DSC can accurately determine the phase transition temperatures and the associated enthalpies. As a consequence, how the chemical structure of lipids translates into thermodynamic properties can be systematically studied. In addition to determining the physical properties of pure lipids, the miscibility and phase behavior of lipid mixtures can be determined.

The detailed review of the interdigitated phase written by Slater and Huang in 1988 provides an excellent outline of the properties of the interdigitated phase and the relevant analytical techniques [6]. Furthermore, the meticulous studies of Koynova and Caffrey describe how systematic changes in lipid chemistry can affect their phase behavior [7-9]. Lipids with asymmetrical acyl chains that form either mixed- or partially-interdigitated phases have also been thoroughly investigated [7,10-12]. This review focuses on the interdigitated phase of fully hydrated phospholipids with hydrocarbon chain lengths of equal size. We pay special attention to recently discovered interdigitated systems and the chemicals that can induce or inhibit lipid interdigitation.

For simplicity, we have centered our review around the extensively studied lipid, 1,2-dipalmitoyl-sn-glycero-3-phosphocholine (DPPC). DPPC is naturally occurring and has thermodynamic phase behavior that is typical for saturated phosphatidylcholines (PCs) [7]. Although DPPC does not spontaneously interdigitate when hydrated, it can be reliably transformed into the fully interdigitated gel phase (Tables 1 and 2). Alterations in the lipid hydrocarbon chains (Figure 1) and the lipid head group (Figure 2) substantially affect spontaneous interdigitation (Figure 3). The predisposition for interdigitation is a finely
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Dluhy RA, Chowdhry BZ, Cameron DG (1985) Infrared Characterization of Conformational Differences in the Lamellar Phases of \( \beta \)-dipalmitoyl-\( \alpha \)-glycero-\( \beta \)-phosphocholine. Biochim. biophys. acta biomembr. 821: 437-444.


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Differential Scanning Calorimetry Studies of Phospholipid Membranes: The Interdigitated Gel Phase


