

CHAPTER I

INTRODUCTION

Star-shaped molecules have been known as non-linear molecules consisting of linear molecules or polymer chains as arms connected at core molecule (Hawker *et al.*, 1995). The star-shaped molecules perform unique properties over the linear molecules in terms of physicochemical performances, such as solution viscosity, and hydrodynamic volume (Inoue, 2000). Thus, the star-shaped molecules can be applied in many applications, for example initiator for polymerization reaction (Robello, 2004), self-assembled functional membranes (Gugliuzza, A. 2010), reactive-surface modifiers (Viswanathan, 2005), etc. Base on the chemical composition of arm molecules, the star-shaped molecules can be classified into two types. Homo arm (or regular arm) type is the star-shaped molecules consisting of identical chemical composition and/or molecular weight of the linear arms (Tsitsilianis, et al., 1991). Whereas, hetero arm (or mikto arm) is the ones compose of two or more arm molecules in different molecular weight, chemical composition, and/ or peripheral functionality (Xia, et al., 1999). In general, the star-shaped molecules can be synthesized by three approaches, (i) the polymerization of monomer initiated by a multifunctional initiator core or core-first approach, (ii) the polymerization of multi-vinyl monomers initiated by a macro-initiator or arm-first approach, and (iii) the coupling reaction of functionalized polymer chains onto a multifunctional linking agent or grafting-to approach (Matyjaszewski polymer group. 2011). Although the preparations of star-shaped molecules are well established, the fact that, the conventional synthesis deals with multi-step reactions, low-yield of obtained products, and complicated purifications.

In recent years, our group has focused on supramolecular chemistry of benzoxazine-based small molecules. Benzoxazine dimers obtained from ring-opening reaction of benzoxazine monomers were clarified as supramolecule through hydrogen bond network of its di-phenolic structure (Chirachanchai *et al.*, 2009). The benzoxazine dimers also perform the unique reactions for selectively preparing macrocyclic compounds through either esterification (Laobuthee and Chirachanchai, 2002) or etherification (Rungsimanon *et al.*, 2008).

Here, it comes to the question the star-shaped molecule can be prepared in a simple approach through the chemistry of supramolecular benzoxazine or not. The present work focuses on studying the synthesis of star-shaped molecule through the reaction between benzoxazine dimer and tetra-tosylated core molecule systematically. The mechanism of this reaction is also proposed as model case for star-shaped molecule synthesis via substitution reaction of phenolic-based arm chains and multi-tosylated core molecule.

