Synthesis and estimation of gelation ability of c3-symmetry tris-urea compounds

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The driving forces for the low molecular weight gelators (LMWGs) where it self-assembles are due to dipole- dipole attraction, hydrogen- bonding, π- π interactions, and the van der Waals forces. For the construction of an LMWG, it is efficient if it uses low symmetry structures as well as alkyl chains that are lengthy. Thus, the LMWGs or cholesterol- based LMWGs consists of lengthy alkyl chains are formulated. C3- symmetry LMWGs has structures that are of high symmetry however most of the structures have long alkyl chains that were attached.

There are positive attributes of using LMWGs such that it has solution-gel phase transition that are reversible and responsive to stimuli. Some examples are ultrasound, redox, photo and chemical stimuli which is created by a gelator of rational design. The C3- symmetry tris- urea LMWG has property that is it can gelate various solvents that are organic which is then succeeded by a quick sonification. The examples for the organic solvents used are acetone and methanol. The gel of the acetone for C3- symmetry tris urea LMWG, was changed into a solution that is homogenous by the addition of anions and re- gelated by the addition of a Lewis- acid.

Furthermore, it is irradiated by ultrasound. Due to this kind of LMWG, varying derivatives can be made from the structure which is highly symmetrical and poly-functional. The preparation of the derivatives systematically and its gelation property evaluation gains an important detail which involves the design of the gel that is supra-molecular and functional. Five regions composes the tris- urea LMWG namely: urea moiety – positional isomers, part of the hydrogen- bonding, nitrogen substituent on outer urea, linker

moiety attached to the outer part of the aromatic ring and another substituent on the central- aromatic ring. The urea moiety is very important for gelations because the derivatives amide and N- methyl urea has no ability for gelation. Thus, the urea moiety was fixed on the part of the hydrogen- bonding where it is also combined with the aromatic linkers at the meta- position of the original derivative of tris- urea LMWG. The structure of the LMWG was divided into five areas and 22 varying derivatives were synthesized. The most importantl structuraL -characteristics can be identified by tests for its ability of gelation with different solvents that are organic. The design for the tris- urea LMWGs have guidelines that are taken from the inspections. The analysis showed that the functional group urea is important for the LMWGs structure. The substitution on the meta- position of urea moiety works for the gelation while on the ortho- postion shows negative results in the formation of a gel. Substitution on aryl of the peripheral nitrogen of urea works effectively in attaining a high- gelation ability. If the aryl group substituent is bulky, the gelation would not occur. It is important that on the aryl cycle core, exists a small group substituent in order to develop the ability of gelation.

For the gelating solvents that are non- polar, it is effective to use a solvo-philc alkyl substituent. The linker region’s flexibility is works succesfully in preserving the ability of gelation. The LMWG derivatives yield great developments on the ability of gelation. THe hypothesis of the authors were confirmed since it showed positive results on the use of low- symmetry structures in producing gelation abilities. Compounds that has low molecular

weight yields physical gelation from bonds that are non- covalent such that of hydrogen- bonds (Hanabusa & Suzuki, 2014). The gelation occurs due to the arrangement of molecules in fibrous assembly which forms three-dimensional networks. This gelation is a result of the non- covalent interaction such as van der Waals forces, the hydrogen- bonding, electrostatic interactions and the π- π interactions. Gel electrolytes of low molecular weight are thermo- reversible.

Thus, the electrolytes melt above the transition temperature of gel to sol phase which reverts back to its form when cooled (Bielejewski et al. , 2015). The gel- electrolytes that is based on LMWGs have its potential utilization on devices that are electrochemical (Terech & Weiss, 2006). Reversible transitions of sol- gel in gelators are responsive to stimuli such as counter ions, redox, light and pH (van Bommel et al. , 2007). These kind of gelators were achieved in various designs of gelators. The sol- gel transitions may be achieved through introduction of a host molecule that is artificial into the LMWGs. It is confirmed that the urea aggregation was inhibited due to anion-binding (Stanley et al. , 2006).