

Supplemental Information

Kinetics of formation of self-assembled structures

At higher pH as observed from the infra-red spectroscopic measurements, vesicles and spherical structures assemble due to the formation of anion-acid hydrogen-bonds and the structures formed close readily to form spherical shapes. When images were taken for samples grown between 1-4 days, smaller nanospheres in the range of 20-50 nm were obtained (Figure 1). However after a week, the sizes of the spherical structures increased, most likely due to layers formed around the inside spheres which gave rise to donut like structures. This trend was more pronounced at higher pH. Well-separated structures were observed up to two weeks, after which aggregation was observed and the samples had to be sonicated in order to separate them.

However, at lower pH, the carboxylic acid groups are not deprotonated and stronger hydrogen bonding interactions are observed thus, there are alternatives to the self-assembly process and the initial structures formed are open ended allowing for growth into tubular structures. Further the presence of longer aliphatic chains between the amino acid head groups allows for bridging between adjacent ends of the growing tubes, stabilizing them. This is most likely why longer tubular structures are observed in the case of the bolaamphiphiles with longer aliphatic chains connecting them (figure 2). This is also confirmed by TEM images obtained at shorter periods (1-4 days) and the continual growth upto 2 weeks. After three weeks, hierarchical assemblies leading to tubular aggregates are formed.

In general, the bolaamphiphiles involved in the self-assembly process in this work have aromatic head groups, thus stacking interactions also play a role.

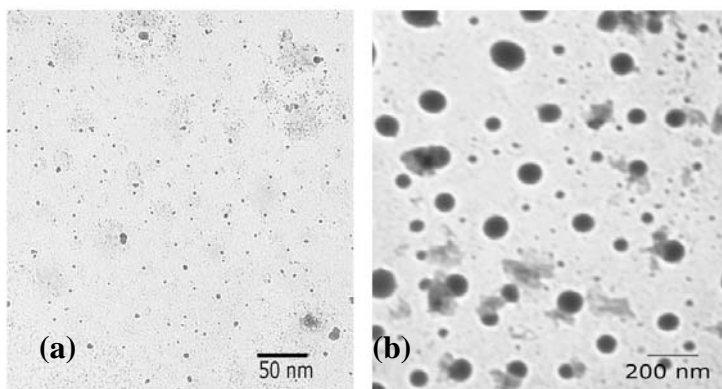


Figure 1: (a) Spherical structures formed after 2 days; (b) structures observed after 7 days in high pH using bis (*N*- α -amido-Phe)_{1,3} propyl dicarboxylate at pH 9

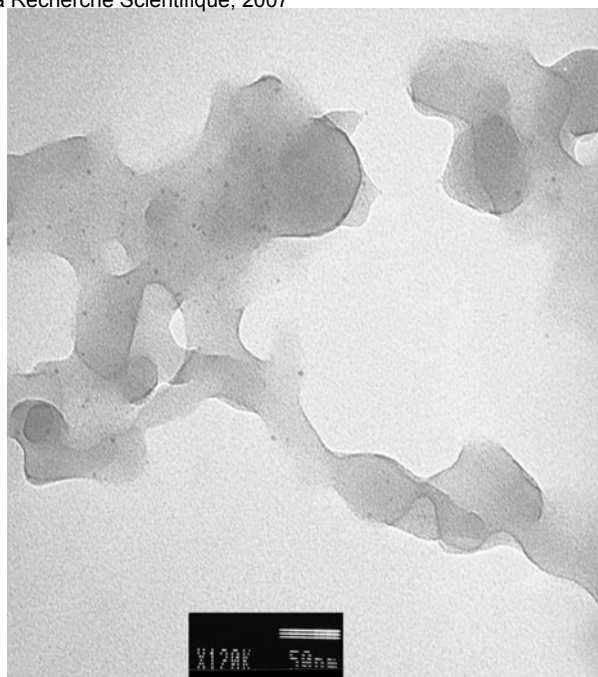


Figure 2: Formation of tubules observed after 5 days, using bis (*N*- α -amido-Phe)_{1,7} heptyl dicarboxylate at pH 4.