***Primordial group transfer potential: Exploring the chemistry of thioacetate through thiolysis***

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“Where Do We Come From?” is a fundamental question to humans. Origin of Life research is the field on how initial life was born and evolved on the early Earth. We are studying the origin of life in terms of prebiotic metabolism, especially focusing on group transfer potential in prebiotic metabolism. Here, we propose that thioacetate is one of the most ideal molecules for initiating the buildup of biomolecules and formation of metabolism.

While thioesters have been proposed to have been relevant molecules with high group transfer potential, thioacetate is simpler since it requires an only carbonyl group and sulfide, rather than a carbonyl and a thiol. The hydrolysis energy of the C-S bond in thioacetate and thioesters is almost equal to the phosphate bond of ATP. Thus, this molecule is thought to be the precursors of ATP in protometabolism. Said in a different way, thioacetate could have served as a central intermediate in early energy conversions needed for the origin of life.

Not only can thioacetate provide energy to accomplish otherwise endergonic reactions, it can be converted into other important molecules such as phosphate and peptides. So, it can be said thioacetate is quite important and relevant for prebiotic metabolism and the origin of life, however, the chemistry of thioacetate is largely un-explored.

Here we will present a project about thiolysis reaction concerning the study of thioacetate. Thiolysis means the degradation of thioester into thioacid in the presence of sulfide. We observed thiolysis with the goal of understanding early energy exchange between thioesters and thioacids.

As the problem of regarding thioacetate as the center of primordial metabolism network, it is said that the speed of hydrolysis of thioacetate into acetate is usually too rapid; Thioacetate can get hydrolyzed easily since it has a high energy bond and couldn’t have accumulated abiotically enough because of this nature. If thioacetate would have been unstable on early Earth, it would have been impossible that thioacetate had provided energy for other reactions. It is a big obstacle for those who support thioacetate.

But we found out that thioacetate stability is pH dependent and identified conditions where thioacetate can exist stably.

We also found that predominant thioacetate species become different at each pH. There are some possible candidates for the site where first life was born, and pH is different at each site. We can now draw different models how thioacetate could contribute to prebiotic metabolic networks for each pH, each possible site for the origin of life. My research reinforced the hypothesis that thioacetate was once the core in prebiotic reactions.