

## **Organic Wastes: Is It Really Waste?**

**Dr. Elsayed Elbeshbishy**

Associate professor, Civil Engineering Dept., Toronto Metropolitan University, Toronto, Ontario, Canada

My research team, Environmental Research for Resource Recovery (ER<sup>3</sup>) group, is developing technologies to convert waste to value added products such as energy and chemicals. We are changing the perspective of seeing garbage and wastewater as a WASTE and consider it as resources. We are mainly working on two processes, anaerobic digestion and dark fermentation, to convert the waste to bioenergy and chemicals. Anaerobic digestion is a process where bacteria consume the organic waste and produce biomethane that can be used for many applications such as renewable natural gas for transportation. Dark fermentation process can convert the wastes into either hydrogen or value chemicals such as volatile fatty acids. Those two processes, anaerobic digestion and fermentation, have many challenges.

In the presentation, I will cover briefly the basics of anaerobic digestion and dark fermentation, current status, associated challenges with these technologies and our current researches going on for overcoming the technologies limitations with novel approaches. We are investigating different techniques to improve the efficiency of the anaerobic digestion such as combining acidification process with thermal pretreatment prior to the anaerobic digestion process. We are also investigating different pretreatment technologies such as chemical (acid, alkaline, oxidants), mechanical (ultrasonic), and thermal both individual and in combination. On the other hand, I will also share some successful approaches in overcoming some of the dark fermentation process to produce high grad volatile fatty acids from organic wastes. Various techniques to improve the dark fermentation process will discuss such as vacuum fermentation, decoupling the solid retention time from hydraulic retention time by solid-liquid separation, temperature, and thermal pretreatment prior to fermentation process.