There is a variety of methods available for hog manure treatment. Traditional aerobic methods such as lagoons and oxidation ditches are no longer affordable to hog farmers after the world energy crisis due to high cost of equipment investment and operation maintenance. Anaerobic treatment usually involves two methods—an anaerobic lagoon and anaerobic fermentation. Although the cost of equipment and manpower are extremely low, the operation of anaerobic lagoon would require vast land and often result in underground water contamination. As the result of production of methane gas as a useful fuel during the process of anaerobic fermentation, the application of this method has been reassessed after world energy crisis.

The merits of anaerobic fermentation (McCarty 1964) involves; (1) a high degree of waste stabilization, (2) low production of waste biological sludge, (3) low nutrient requirements, (4) production of methane gas as a useful end product, (5) no oxygen required; although there are some pitfalls in the method involved such as the limitation of temperature and the slow growth rate of methanogenic bacteria. Besides, anaerobic fermentation can be used to treat extremely high concentration of waste.

Simplicity in operation, management, as well as low cost have attributed to the advantage of anaerobic treatment over aerobic methods. Undoubtedly, anaerobic fermentation is affected by temperature, but its operation can be conducted successfully in winter. If there are some types of insulation apparatus or keeping-warm facilities attached to the fermenter, or alternatively if the fermenter is laid underground to eliminate its heating on the ground surface and to decrease temperature fluctuation as influenced by the outside environmental conditions, there would result in increasing efficiency of overall fermentation process with shorter retention time and less the required fermentation volume.

Red mud plastic (RMP) material developed in 1975 by Union Industrial Research Lab., Taiwan (UIRL) has been successfully used to construct fermenter for the experiments of anaerobic fermentation of swine manure conducted by Taiwan Livestock Research Institute. Up now, RMP fermenter is gradually being accepted by Taiwan hog farmers to replace current water-solvent type made of red brick and cement. RMP fermenter has been manufactured and exported to more than 20 different countries.

The primary ingredients of RMP material consist of red mud and the wastes from aluminum processing plant. It is an excellent material resistant to acid, alkali, salt and ultraviolet light. According to aging test results conducted by UIRL, a RMP sheet of 1.2 mm thickness could last for more than 20 years.

The bag show inlet and outlet tubes made of PVC. Both tubing must be immersed into the fermentation portion of the bag to prevent the escape of methane gas from the fermenter. Also in the air space portion there is a gas tube leading to the collecting point to be utilized.

The Biochemical Oxygen Demand (BOD) of the effluent from RMP fermenter for 5 days hydraulic retention time is usually less than 200 p.p.m. But the effluent still consists of abundant nutrients especially in high nitrogen source that can be further utilized as either organic fertilizer in irrigation system or culture medium for high-protein Spirulina production. The application of the effluent for algae cultivation not only can produce algae for animal feed but also can achieve a second-treatment facility to further improve the standard of swine drainage water.

In the beginning of algae culture, water is initially introduced to the pool up to about 15 cm depth, then a cm depth of concentrated algae fluid with optical density (OD) higher than 1.0 is transplanted. Spirulina concentration after transplantation is normally ranged between 0.5 to 0.7 OD. It is important that in the normal growth of Spirulina, it is necessary to add the effluent to algae pool daily. The amount of addition depends on NH3-N conc. in it. Too high conc. of NH3-N would yield toxicity to algae, but too low conc. would result in lack of nitrogen source leading to the retardation of algae normal growth. Optimum NH3-N conc. added to culture medium is found to be 0.2 ppm (Chia et al., 1980). If NH3-N conc. is over 0.2 ppm, Spirulina growth appears to be retarded. There appears no growth of Spirulina at all if NH3-N conc. is over 1.0 ppm. Usually it would take about 2 weeks for Spirulina to grow from its initial conc. of OD 0.1-0.2 to 1.0 which is considered ready for harvest. The yield is about 7.5-9.7 g dry weight per m² pool area per day.

The fermentation effluent is abundant in various nutrients but lack in carbon source due to the fact that most of it in hog manure has been converted to CO2 in the biogas after anaerobic fermentation. The availability of carbon source nutrient in fermentation effluent thus becomes a limiting factor for algae protoplasms synthesis. Thus far, an experimental design has been undertaken to allow complete mixing of the biogas produced and the liquid feed so that it would not only eliminate CO2 and H2S in the biogas to achieve its purification purpose but also provide enough carbon source for algae growth to increase its yield. Preliminary results are very promising. Further work in this direction is in progress.

Mathem generated from anaerobic digestion of hog wastes can be utilized as fuel for stoves, gas lamps, ammonia-water absorption refrigeration system, vehicles, water pumps, grass mowers and generation of electricity, etc.