# Bio*Ag* DFD® Effluent Digester [Concepts]

## Background

BioAg DFD effluent digester is produced by way of a seed culture based on microbial populations sourced from functional dairy effluent ponds.

DFD has proved to be effective in the dairy industry, the pig industry, wineries and other intensive industries where odiferous effluent is a by-product of the process.

DFD has proved effective throughout Australia, New Zealand and the United Kingdom, over the last eight years.

## Production Outline

DFD is produced via open-headed fermentation under aerobic conditions.

The seed culture is returned to the production process and undergoes a 72 to 96 hour replication and reactivation process during which the microbial populations are fed and checked for viability.

After this some of the material is returned to the seed tanks for use in subsequent batches and the remainder is sent to the culture tanks where over the next 20 days or so, seaweed, molasses, fish emulsion and other raw materials are added to support the microbial population. Various physical parameters such as temperature, aeration and agitation can be altered to ensure the batch meets specifications, such as brix, pH, specific gravity and microbial activity. These are checked daily during the fermentation process.

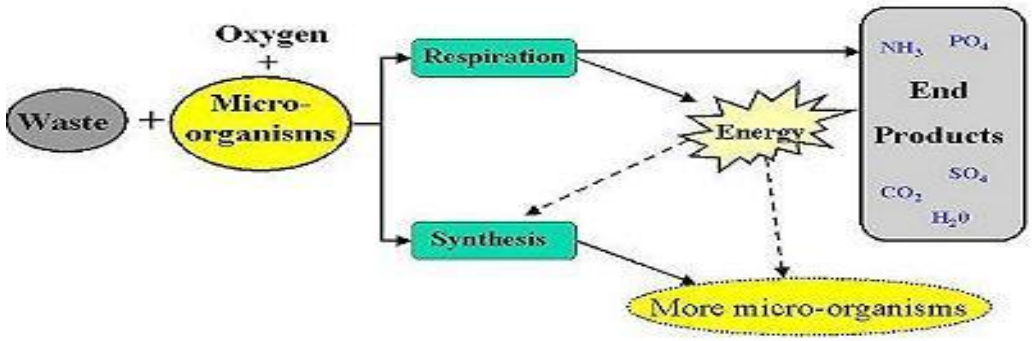
Towards the end of the fermentation the batch is ‘shut down’, then filtered and sent for storage and shipment to clients.

## Usage Background

Dosing with DFD leads to immediate and vast increases in aerobic and facultative anaerobic bacteria numbers.

This increase in numbers pushes digestion in the pond towards an aerobic process.

Diagrammatical representation of aerobic digestion[i]




The end products of aerobic digestion are carbon dioxide and water, the process is fast in a biological sense.

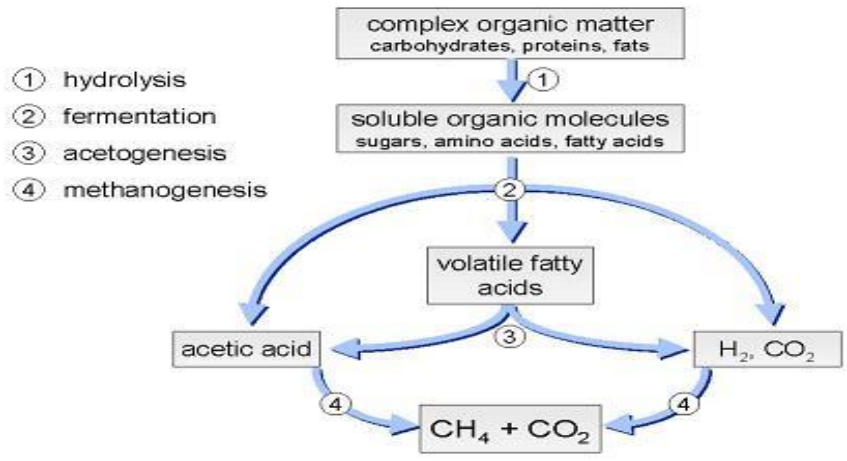
The production of carbon dioxide can be seen in the 'bolling' witnessed in DFD treated ponds.

https://www.youtube.com/watch?v=5rUQrLfVwHY

By contrast digestion in most effluent systems quickly develops into and anaerobic one.

The result is a slow breakdown in solids and the release of methane, some sulphur dioxide and other malodourous sulphur compounds such as mercaptans.

Diagrammatical representation of anaerobic digestion[ii]



## Volatilisation Risks & Nutrient Levels

- DFD converts free nitrogen in ponds to organically bound nitrogen due to increases in the microbial biomass.
- Each unit of microbial protein contains approximately 6.25 units of nitrogen
- "Bacteria measurements at week 12 indicated significant increases in aerobic bacteria for the DFD treated slurry compared with the control, whereas anaerobic bacteria were lower"[iii]
- Troston Piggery trial in UK[iv] results showed:
    - Three months after commencement of trial
        - Total aerobic bacteria increased by 27 times
        - Total nitrogen up by 10%
        - Ammonium-nitrogen proportion decreased from 80% to 50% of total nitrogen
        - Organic-nitrogen proportion increased from 20% to 50% of total nitrogen

## Microbial Composition of DFD

As DFD is sourced from naturally occurring microbial populations it has not proven possible to individually identify the species of microbes in the mix. Traditional plate microbiology followed by chemical testing such as indole reactivity fails to give species ID but gets stuck at families such as bacillus and pseudomonas spp. BioAg has considered ID by way of gene sequencing, but this is extremely expensive and the genome of all but the most important medical pathogens is as yet incomplete.

Morphological examination under the microscope shows a wide range of microbial types including protozoa and many fungi. As was stated earlier the seed culture contains a wide range of biota.

The product also contains free amino acids and other metabolites of the fermentation process that act a feedstock to support existing aerobes in the feedstock.

*In vivo* testing has shown that entropathogenic bacteria such as E. coli will not survive in solutions of DFD, most likely due to competition and/or unsuitable growing conditions. DFD is not biocidal!

## Speed of Action

This depends to a large extent on the feedstock coming into the effluent stream, but the odour compounds are the first indicator that the DFD is become active. The odour profile can change in as little as 72 hours.

Breakdown of the crust (if present) and 'bolling' follow, in most situations the pond will stabilise into being a "BioAg" pond within three months.

## Other Features

- Fertiliser offsets
- Carbon capture
- Less pond maintenance
- More balanced nutrient levels
- Pumpable slurry

- DFD treated effluent has been shown to have most of its nutrients in a biological available form rather than in a mineralised form[v]

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[i] http://water.me.vccs.edu/courses/ENV149/lesson4b.htm
[ii] http://water.me.vccs.edu/courses/ENV149/lesson4b.htm
[iii] Kingshay Dairy Research Centre – Somerset [UK]. Independent Digest-it trial 2011
[iv] Thomson & Joseph Ltd (UK) 2011
[v] National Measurement Institute results for total phosphorus against biological available phosphorus and NRM labs (UK) for total nitrogen against organic nitrogen