Effluents evaporators and dryers.

SUSTAINABLE AGRIBUSINESS:
PALM OIL MILL EFFLUENT (POME) VS PROFITABILITY

A STATIC AGRIBUSINESS

In the past 40 years, the palm oil agribusiness has had a fast growth in size but a slow on the technological aspect. Plantations and milling technologies did not change much and Crude Palm Oil (CPO) production (4 T/ha-year) did not increase despite agronomic research, Research and Development (R&D) and a complete understanding of the genome. Additionally, year after year, soil quality is poorer, biodiversity is lower and chemical inputs increase (in the form of fertilizers & pesticides). We made a leap forward with R&D, yet a step backward again on oil production. This is a surprisingly static/negative picture for such growing and profitable business. What are we doing wrong?

FOOD FOR THOUGHT

A palm oil business does not export nutrients (N, P, K, etc.) via CPO, but only C, H, O (carbon). Yet, why do we still have to fertilize our plantations every year? Why do we increase fertilization and still get the same average CPO yield (at regional scale)? Have we made historical trend analyses between oil production and Organic Matter (OM) content in the soils? Soils of the Amazon basin in Latin America are nutrients-poor. Nevertheless, this is one of the world's region with major biomass production.

The nutrient content of POME is around 15% of the POME dry matter (DM). It means a 100,000 T FFB/year mill releases between 600 and 750 T of nutrients per year (= 500,000 US$/year). Why then, are we disposing them to the watercourses (via ETP)?

In most countries, the recycling of the agricultural effluents and organic wastes are normal practices (Europe, Brazil, Mediterranean basin, etc.). Depending on the country and of the effluent type, environmental authorities use to define some guidelines to mitigate potential negative impacts of the effluents/ waste recycling. Organic matter and nutrients recycling are encouraged and acknowledged as a key component in sustainable agriculture. Most farmers of the world agree on the importance of returning organic matter and nutrients exported from agriculture, back to their soils to increase yields as well as resistance to pests.

Agricultural engineering and organic fertilization are part of the environmental solutions, they are not "the problem". Organic fertilization in its simplest term is basically the normal OM cycle that happens naturally, anywhere on the planet (rainforests, mangroves, etc.). Hence, it seems unreasonable for environmental authorities to set COD and BOD discharge limits for land application of POME. Why not apply them to leaves, fronds, animal manure or chemical fertilizers in the name of "environmental protection"? Should this happen, the planet would become a desert in less than 100 years; no exaggeration. Constraints have to be made on application ways and doses, not on COD or BOD concentration. COD application is only detrimental to the environmental if it is not monitored, hence the feared runoffs into water sources. Higher the COD, better. This is the fundamental of organic fertilization.

In short, environmental authorities should regulate the application method (by applying the knowledge in agricultural engineering) and the application doses, instead of imposing an indiscriminate ban without consideration of nature's intended way of OM recycling. With a regulated land application of effluent, the industry can be more sustainable and at the same time reach a "zero discharge" and by the way no negative impact on the environment.

FORLIM system (monitored & dosed organic ferti-irrigation).

A FEW SOLUTION PATHS FOR EFFLUENTS LAND APPLICATION:

1 Solid Application

There are two main pathways to get solid fertilizer from liquid effluents:

- for suspended solids (SS): sludge dehydration (with or without drying up to 95% DM) for dissolved solids (DS), evaporation and drying (up to 95% DM).
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SS: The suspended solids separation and sludge dehydration is a common technology in the wastewater treatment sector. It requires flocculants. The final cake (around 25% DM) can be applied on land (not so easy) or dried up to 85% DM or higher. When plantations are close, their organic fertilization is usually the easiest and most practical way to take advantage of its high nutrients value, especially in Nitrogen. When plantations are far, or when the mill has no plantations, the marketing of this dry bio-fertilizer is a quite practical option.

DS: The separation of dissolved solids from water in the effluent is more complicated, more expensive and less commonly done but it is already a successful and widespread technology in the treatment of vinasses from bioethanol production, which are very similar to POME (COD 100,000 ppm, pH 4). It has also been applied successfully to POME in India (ref. BIOTEC). The final (powdered) bio-fertilizer has a composition around (4 - 4 - 12- 2,5 - 2,5 - 2,5)% of (N-P-K-Mg-Ca-S) + 50% humus + 20% inactive compounds. Its market value depends on its form and packaging, on the crop type and on the distance to the crops (for logistics). It is around 300 US$/T. This option is particularly suited to mills with no plantations.

2 Liquid Application

Some countries, like Malaysia, have a negative impression of liquid effluent application to land and defined stringent regulations for BOD / COD removal before land application, as it is for final discharge in the water bodies. This can be understood as a mistrust in seriousness of the industrial sector, considering that neither the industry neither the DOE is able to monitor the land application (old times); consequently a more relaxed regulation would unfortunately be open to abuse by some industry players, in pursuit of maximized short-term profits.

Other countries, like Brazil, opt for a nutrient limit per hectare, to avoid over-fertilization. This seems to be more reasonable for sustainable farming.

The misconception in Malaysia is probably due to the image of "land application" which is a rudimentary system to "get rid" of the effluents. For the average palm oil mill, this traditional "land application" consists of a distribution of all the (lagoons) treated effluents to around 80 hectares of plantations with a furrow system. In Indonesia, land application is "more advanced" as it is applied on a larger area and with the parallel objective to reduce chemical fertilizer consumption. But in both cases, there is not much of a monitoring system of the application, neither the objective to eliminate chemical fertilization.

Ferti-irrigation is today a well-known technology all over the world in other industries and in wastewater sanitation. A few mills in Latin America have started several years ago a (SCADA) monitored dosed application on each palm (piping network + drip or spray application) – called the FORLIM technology – with impressive results, achieving zero chemical fertilization and the maximum possible yields in function of the genetics.

A STRATEGIC BUSINESS CHOICE

In some cases, POME treatment + polishing is the best option for the mill as far as environmental compliance is concerned. But the mill also should understand that to throw nutrients and organic matter to the watercourses instead of the land will have economic consequences for the business in the long run (limited FFB, OER and oil production + permanent and increasing O&M costs). Additionally, it is expected that like in other countries, the local environment authorities will at some time also ask for nutrients removal, what will represent an additional investment and O&M cost.

In other cases, zero discharge is the best option for the mill, to recycle organic matter (OM) and nutrients to the plantation or to sell it as powdered (or granulated) bio-fertilizer to the market.

In any case, there is a responsibility of the environmental authorities to work with the sector, such as via MPOB, to allow both options, monitor them correctly and drive the sector to a sustainable and more productive business.

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