

VAP TECHNOLOGY

PRODUCTION TECHNOLOGY OF HIGH-QUALITY ORGANIC FERTILIZER FROM POULTRY MANURE /DEJECTIONS/LITTER

Patent **EP 1314710 A** process of maturing and stabilizing biomasses under reduction of smelling emissions.

➤ CRITICAL ISSUES

Poultry Manure, with or without litter, represents the main by-product of poultry industries. Poultry manure, like guano, is very rich in organic matter and nutrients, especially nitrogen (N) but also phosphate (P). Manure characteristics mostly depend on the types of animals raised (broilers, laying hens, turkeys, ...) and the management system of the farms, as well as the manure processing.

Poultry manure has always been used in agriculture for its fertilizing power, but its direct use or poor management can create problems for both crops and soils (excess nitrogen, phytotoxicity, salinity, ... unripe products compete with plants for the use of nitrogen). Most of the nitrogen is present in the organic form urea that is rapidly mineralised, giving rise to a "ready-made" fertiliser, which is difficult to be compatible with pre-seeding distribution. Some nutrients, particularly nitrogen, may leach out before assimilation by plants; therefore, they may lead to water pollution (both groundwater and surface water). The **NUE** (Nitrogen Usage Efficiency) value is therefore reduced. Often, intensive poultry farms are concentrated in limited areas; consequently, there is not enough land around them for poultry manure distribution and management.

On the other hand, at a global level the importance of fertilization for food production is known; it has also been recognized that mineral fertilization alone is no longer sufficient. The key concept is integration with organic fertilization to maintain soil fertility.

The usual problems of poultry manure as fertilizer are overcome by the technology proposed by ADA using the specifics described in the technique of EU patent EP1314710.

The technique can be applied to any type of fowl manure, litter, and animal dejections, hence all the by-products of avian industries for eggs and poultry meat (laying hens, broilers, turkeys, ducks, ... ostriches).

➤ INNOVATIVE ASPECTS AND RELATED BENEFITS (with reference to the most common technologies)

Innovation is connected both to the production process and to final organic fertilizer features.

The production technology is based on biological processes of stabilization and maturation of manure with natural **BIOSYSTEMS**. The treatment is **simplified**, with enzymatic biosystems processes combined with **static** reduction of odorous emissions. The technology needs low energy and water input.

The fertilizers obtained by manure treatment with ADA technique are rich in organic substance, macro and micronutrients with the following distinctive features:

- reduced salinity,
- slow-release of nitrogen,

- important P fraction in the form of struvite, poorly leachable but available for plants,
- increase in soil water retention.

The increase in soil water retention allows more water to accumulate during rain events, even intense ones due to changing climatic conditions; this water can be released slowly over time, reducing irrigation needs during crop harvesting (water saving, mitigation of climate change).

ADA technique has environmental and economic sustainability:

- material recovery, waste prevention, low environmental impact, circular economy, low energy requirements.
- an "environmentally friendly" final product, partial replacement of mineral fertilizers (e.g. P-based), with savings in water, energy, reduction in greenhouse gas emissions (GWP-CO² eq.).

➤ USE/APPLICATION

ADA offers you the option of choosing to either produce improved fertilizers with the technique or directly buying the matured fertilizers we can produce with your manure.

We can distinguish three different "products" following different management processes:

- Production of the fertilizer by an **external manufacturer**, therefore with the transfer of the client's by-product (manure) to an external agent for obtaining the fertilizer;
- Direct **production "on farm"** (directly in poultry farms) - on farm treatment means transforming the storage phase into a production area, with advantages in terms of time and costs;
- Transfer of the by-product to the end user (agricultural farmer) for obtaining the fertilizer directly at the end user's premises.

➤ ACTIVITIES

The technology was developed by two Italian companies (Amek srl, Ferrara and Cooperativa Trasporti Imola SCRL) obtaining the European patent for the technology (EP1314710, 2012) and then acquired by ADA.

Over 20 years of experimental activities and demonstration applications have been carried out.

- The application was tested on intensive laying hen farms (EUROVO Group) in Romagna, and the final fertilizer tested with agronomic tests both in open field and in protected crops by CISA M. NERI (Imola, years 1999-2010). The results were the basis for FERPODE project.
- The technology was developed in the European Project "**FERPODE**" (2008-2011) *Introduction in the market of a new high quality organic FERTilizer obtained by the use of POultry DEjection* - Contract ECO/08/239083 for the development of special organic fertilizer (low salinity and slow-release N).
- The activities went on through European projects with new objectives: the patented technique was used to obtain other products – bating agent or soil bioactivator – from poultry manure/litter/dejections (**projects 2.2, 2.3 and 2.4**).

The demonstrative applications were carried out directly on farm, with the use of the manure storage areas present on the farm as the enzymatic treatment site.

Collaborations with private companies and public research institutions have been numerous and integrated; among the latest we report:

- ENEA (support for experimental design and pilot application);
- Arpa Emilia-Romagna, both for analysis of the by-product in all its phases and for emissions issues (ammonia and odorous compounds) into the environment;
- IZSLER, Istituto Zooprofilattico Sperimentale of Lombardy and Emilia-Romagna - Forlì headquarters, for the hygienic-sanitary aspects of the fertilizer;
- Bologna University – Veterinary Faculty and Engineering Faculty.

➤ RESULTS

The main results are:

- innovative organic fertilizers** with special features, which can partially replace or integrate mineral fertilization (e.g. urea and superphosphates);
- an **innovative technique** to produce organic fertilizers from by-products (poultry manure/litter/dejections).

- The **final organic fertilizers with reduced salinity** (in the range 3÷4 mS/cm) are organic matrices with Organic Carbon content like a compost (25÷30%), rich in macronutrients (N, P, K) containing all micronutrients, rich in microorganisms useful for soils.

The final product is an **edaphic fertilizer**: it combines the protective action for the soil, due to the organic matter supply to the soil, with the fertilizing action for the plants by providing nutrients (N, P, K, S, B, Ca, Co, Fe, Mg, Mn, Mo, Zn, ...).

Feature - slow-release N: the laboratory tests were confirmed by field tests carried out on vegetables (potatoes, tomatoes, melon and winter melon), with a prolonged N release to the plants for a longer time compared to commercial poultry manure, allowing its compatibility with pre-sowing unique distribution.

Feature - presence of struvite, a Mg and ammonium phosphate, a slow-release fertilizer for P and N, which is poorly leachable but available for plants.

- It is a **simplified technique**: with a maturation process in static heaps based on natural biosystems, which therefore requires low energy consumption and does not require water.

It is a **sustainable** production technique: the production of the final fertilizer has a lower impact than the equivalent production of mineral fertilizers: GWP < 50%, therefore a **CO₂ eq emission < 50%**.

It is a **flexible technique**, which can be adapted to any customer request and soil need, through the customization of the enzymatic preparation, depending on the needs of the soil/soil system and climatic conditions.

Agronomic results: It has been tested on cereals (wheat and corn) and in horticulture (potatoes, tomatoes, peppers, chillies, melons, salad...). One unit of nitrogen from FERPODE fertilizer corresponds to 1.3 units of nitrogen from traditional manure-based fertilizers.

➤ Training

Experimental activities were carried out in synergy with training activities; several master's theses have been carried out on this project at Bologna University (DICMA, Engineering Faculty) and ENEA. An annual SPINNER scholarship was conducted to investigate health aspects.

The specific objective of the work was to verify the sanitation of dried laying hen manure obtained with biosystem treatment; during the treatment, the reduction of 5 log 10 units of *Enterococcus faecalis* and 3 log 10 units of *Parvovirus* were verified, according to indications contained in the Regulation CE 1069/2009. The activities were carried out in collaboration with Arpa Emilia-Romagna, IZSLER - Forlì headquarters, University of Bologna - Faculty of Veterinary Medicine.

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