

Lecture No.3 Fermentation products

Many biotechnology based bio organic products for use in nutrition of veterinary poultry bioorganic products manufacturer crop-agriculture fermentation and human

Products range the products categories, animal nutrition / poultry supplements, seed coating polymers, peptones (fermentation supplements), construction chemicals, organic fertilizers and organic manures special agricultural adjuvants, organic minerals nutritional supplements, flavor enhancers, cosmetic ingredients

Animal nutrition/poultry supplement due to the stress on animals, poultry it is necessary to offer them the nutrients in easily bio available form. Our range of poultry feed supplement are highly effective organic minerals. Water soluble organic trace minerals are specially formulated to take care of trace mineral deficiencies in ruminants, particularly dairy cows.

Seed coating polymers various colours of seed coating polymers allows to differentiate the various varieties of same seed.

Organic plant nutrients: organic fertilizer/organic manure e.g. Seaweed extract technologies, protein hydrolysis technologies, developed & mastered mineral chelation techniques, humate extraction technologies, polymer production technologies

Organic minerals: high quality nutritional supplement ingredients for human such as iron supplements and organic metals. Iron/haematinic products, ferric pyrophosphate, iron protein succinylate, ferrous caseinate, ferrous bisglycinate, ferrous ascorbate, ferrous glycine sulfate.

Construction chemicals natural origin foaming agent (foamcrete) is concentrated with enzymatic active components, and is developed for the construction building material industry.

Peptone: fermentation nutrients, peptones are used in microbiological culture media to support the nutritional requirements of microorganisms. Industrial fermentations and the production of human and veterinary vaccines. Peptones are used in nutrient media for growing bacteria and fungi, detection of microorganisms. Peptones are used in diagnostics, fermentation and cell culture industries.

Flavor enhancers: hydrolyzed vegetable protein flavor enhancer, the hydrolyzed vegetable protein (hvp) flavor enhancer has been developed as a natural alternative to the sodium glutamate hvp.

Nutritional supplements protein hydrolysate casein peptides colysate peptone paste

Processes of lactic acid fermentation natural controlled natural fermentation: - best isolate from natural flora grows during the fermentation process.

Dairy products:- •yoghurt •buttermilk •cheese vegetables •sauerkraut •kanji •kocho •pickles fruits •fermented olives •sweet cherry •caper berries.

Yoghurt: fermentation by culture of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus thermophilus* bacteria, serve as main vehicle of probiotics, positive effects on immune, cardiovascular and metabolic health. It includes: natural yoghurt- clean, slightly acidic flavor, flavored yoghurt- added flavours or artificial sweeteners, greek yoghurt- deliciously thick and creamy texture, set yoghurts- fairly thick, flat surface with fruit or flavorings at base.

Cheese: Cheese texture microorganism involved:

Soft (unripened) such as cottage, cream and mozzarella produced by *Lactococcus lactis*, *Leuconostoc citrovorum*, *Lactococcus cremoris*, *Lactobacillus bulgaricus*, *Streptococcus thermophiles*.

Soft (ripened) such as brie and camembert by *Lactococcus lactis*, *Lactococcus cremoris*, *Penicillium camemberti*, *Penicillium candidum*, *Brevibacterium linens*.

Semi-soft (ripened): gorgonzola and Roquefort produced *Lactococcus lactis*, *Lactococcus cremoris*, *Penicillium glaucum*, *Penicillium roqueforti*.

Hard (ripened) such as: cheddar- *Lactococcus lactis*, *Lactobacillus casei*, *Lactococcus cremoris*, *Streptococcus durans*.

Very hard (ripened): parmesan- *Lactococcus lactis*, *Lactobacillus bulgaricus*, *Lactococcus cremoris*, *Streptococcus thermophilus*.

Buttermilk: less acidulous liquid remaining after butter separation from milk, contains less fat. *Streptococcus lactis* or *S. cremoris* with *Leuconostoc citrivorum* or *L. dextranicum* used. Role of *Streptococci* is to develop the acidity and *Leuconostoc* spp. Produce volatile compounds, giving characteristic aroma and flavor.

Other fermented Buttermilk products microorganisms involved kefir *Streptococcus lactis*, *lactobacillus bulgaricus*; Bulgarian buttermilk *lactobacillus bulgaricus*; Kumiss *Lactobacillus* sp.; Sweet acidophilus milk *Lactobacillus acidophilus*; Sweet cream *Leuconostoc citrivorum*; Sour cream *Streptococcus lactis*, *L. citrivorum*.

Sauerkraut: fermentation of salted and shredded cabbage, high nutritive value due to increased digestibility compared to raw cabbage and relatively low vitamin C losses, using *Leuconostoc mesenteroides*, *Lactobacillus* and *Pediococcus*.

Kanji: fermented black carrot beverage, rich in β carotene, anthocyanins, antioxidants and high probiotics, acquires diuretic, smoothening, hepatoprotective and uterine stimulative properties, consumed mainly in parts of northern India and Pakistan.

Kocho: fermented product from false banana (*Ensete ventricosum*) pseudostem, produced in Ethiopia, has strong odour and a paste-like consistency, pH within the pit decreases from 6.7 to 3.7 within about four weeks.

Lacto-pickles: preservation method for vegetables. Vegetables used for pickling are cucumbers, sweet potato, red onions, turnips. Pickle brine reduces muscle cramping.

Lactic acid fermented followed by NaOH treatment to remove bitterness, the bacteria involved are *L. plantarum*, *L. brevis*, *P. cerevisiae* and *L. mesenteroides*, pH varies between 4.0–4.5, optimum fermentation temperature is 24°C, the fermentation period takes between 2–3 months, packed in air-tight jars and sterilized for a good quality product with long storage life fermented olives 43

Fermented olives

Sweet cherry: these fruits are subject to rapid microbial spoilage by *Pediococcus acidilactici*, *P. pentosaceus*, *L. plantarum* and *L. mesenteroides* subsp. *mesenteroides* isolated from spontaneous fermentation with an increased anti-oxidant activity, high anthocyanin content and good sensory profile of this fruit

Fermented caper berries: fruits of caparis species (mainly *Capparis spinosa* L.), Mediterranean shrub cultivated for its buds and fruits. Fermented capers are indigenous to Mediterranean countries like Italy and Germany. *L. plantarum* is the main species, which was isolated from the brine of capers.

Some important fermentation: ethanol, industrial solvents, beverages glycerol by *Saccharomyces cerevisiae*, food and pharmaceutical acetone and butanol *Clostridium acetobutylicum*, solvents -amylase *Bacillus subtilis* starch hydrolysis

Complicated in industry: mushroom, bread, cocoa, tempeh.

Microbial cell (biomass), yeast, microbial enzymes, glucose isomerase, microbial metabolites, penicillin, vinegar, vitamins B12, riboflavin.

Other Products (beer, wine, acetic acid, amino acid, fermentation, lactic acid, coffee, tea, organic acid, epoxy, succinic acid, malic acid, oxogluconic acids, propionic and butyric acids, green tea, flavored tea, instant tea, cabbage & cucumber, cucumbers, tartaric acid, pyruvic acid, kojic acid, citric acid, nucleic acid, phospholipids, sterols, citric acid)

Ayurvedic and herbal medicines, herbal cosmetics, alcoholic and non alcoholic beverages, drinks, adhesives, industrial adhesive, sealants, glues, gum & resin, activated carbon & activated charcoal, aluminum and aluminum extrusion profiles sections, bio-fertilizers and biotechnology, breakfast snacks and cereal food, bicycle tyres & tubes, bicycle parts, bicycle assembling.

Bamboo and cane based projects, building materials and construction projects, biodegradable & bioplastic based projects, chemicals (organic and inorganic), confectionery, bakery/baking and other food or cereal processing, coconut and coconut based products, cold storage for fruits & vegetables.

Copper & copper based projects, disinfectants, pesticides, insecticides, mosquito repellents, essential oils, oils & fats and allied or engineering goods, fibre glass & float glass, fast moving consumer goods, food, bakery, agro processing.

Fruits & vegetables processing, fertilizers & biofertilizers, herbs and medicinal cultivation and jatropha (biofuel)

Types of fermentations:

Batch fermentation: sterile nutrient substrate, inoculated, grow until no more of the product is being made, "harvested" and cleaned out for another run. Lag phase (adapt to their surroundings), log phase is an exponential growth, stationary phase, death phase

Continuous fermentation: substrate is added continuously to the fermenter, and biomass or products are continuously removed at the same rate. Under these conditions the cells remain in the logarithmic phase of growth.

Fed-batch fermentation: substrate increments as the fermentation progresses. Started as batch wise with a small substrate concentration. Initial substrate is consumed, addition of fermentation medium.