일차배양 쥐간세포로부터 간트리글리세리드 lipase의 유리

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요 약

쥐간세포 배양시 간트리글리세리드 lipase의 유리 및 호르몬 조절에 관하여 연구하였다. 배양 2일째 헤파린 첨가구 배양액에 유리된 lipase 활성은 24시간 동안 계속 증가하였다. 반면에 헤파린 무첨가의 lipase활성은 헤파린 첨가구에 비하여 10%에 지나지 않았다. 간세포를 anti-hepatic triglyceride lipase IgG와 배양시 lipase 활성이 92%까지 저해되었다. Monensin 첨가시 lipase활성 저해는 61%였다. 인슐린은 lipase활성을 20% 상승시켰으며 dexamethasone은 44% 저해시켰다. 이상의 결과로 미루어 보아 간트리글리세리드 lipase는 헤파린 존재하에 분비 및 유리되며 그 분비는 호르몬에 의해 조절됨을 시사한다.

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Safety and Function of Phosphates in Food Processing

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Ladies & gentlemen

It is a great pleasure for me to be invited to speak at the 20th anniversary of the korean society of food & nutrition, I am happy to inform you of the functions and uses of phosphate as food additives and also functional additives in food processing. Let us start first with a general remark that a number of othophosphates, particularly calciumphosphate, magnesiumphosphate and ironphosphate are used as mineral enrichment in dietetic or health food and that another category, the polyphosphates are widely used as functional ingredients and food additives in the processing of the food applications Let us now look into the functions of phosphate blends in the various application

The Use Phosphate as Emulsifiers in Processed Cheese

One of the first applications of phosphate as processing aid was started about 60 years ago as emulsifiers in processed cheese, Our company Bk Ladenburg holds the patent for the first time on the use of phosphate in this area. Generally speaking it is known that processed cheese and its related products are cheese preserved, which means that raw cheese has been converted into a product of reasonable longer shelflife. Cheese is made from coagulated milk occured in a fermentation process during a maturing process. Cheese is a natural product and while the microbiology reaction during the maturing process is not interrupted and maturing is going on the cheese or its by products becomes spoiled eventually. To improve shelfliff processed cheese was invented. There are two ways of stopping or at least retarding the spoiling process

1. Pasteurization, and
2. Sterilization,

Therefore cheese has to be heated up during a certain processing time under constant stirring and due to this it would separate into its basic constituents, water fat and a conglomeration of casein and will therefore completely loose its particular fine structure. This has to be seen as an effect caused by the chemical composition of Cheese material.

The casein complex undergoes many changes as soon as rennet or acid is added and the calcium is bound to the caseinate and precipitates finally as calcium caseinate. The emulsion which contains inclusions of fat particles and to which the water mainly in the form of hydration water is bound are the starting material from which prior to cheese is made from.

This system is collapsing during a heating process, fat and water are separating. This is exactly what processed cheese wants to prevent, because processed cheese is supposed to have a fine structure of an emulsion as similar as possible to the structure of natural cheese, due to the fact that a processed cheese is a fat in water emulsion the fat particle need to be accurately dispersed in a caseinate solution. To prevent the collapse of that structure the calcium caseinate needs to be converted into sodium caseinate and through this is able to react as a protein coating for the fine fat particles, dispersing them evenly in the whole liquid

medium, sodium caseinate can also bind the water contained in the cheese mass and to prevent the separation of liquid. For this purposes emulsifying salts with good sequestering properties for calcium are requested, these sequestering agents are usually polymericphosphate and they act as ion exchanger to substitute the calcium of the original calcium caseinate by forming a sodium caseinate, they are ideal for this purpose because they form insoluble salts with the calcium molecules and therefore prevent crystalization.

These emulsifying salts are particularly designed blends of Bk ladenburg and are marketed under the brand name of JOHA. They are used in a varieties of processed cheese and the phosphate blends with particularly high sequestering properties are used mostly for spreadable processed cheese, low fat processed cheese, for pasteurized processed cheese, cheese dips and for quick melting block cheese,

PHOSPHATES USED FOR MEAT PROCESSING

Polyphosphates are of great importance in a large variety of meat processes. The raw meat material as beef, pork and poultry containg about 70% of water bound to the muscle protein particularly actin and myosin. They linked to each other in a loose network of filament to which the water molecules are bound by electrostatic force. These network structure is maintained by presence of adenosin triphosphate a substance produced in the metabolic process in animals, it is decomposed post mortem within about 20H° after the slaughtering and is not reproduceable by nature. That is the reason that the function of this network structure of muscle protein is not so strong anymore and looses its water absorptive capacity which is absolutely essential for the processing of meat product. The major function of particularly alkali polyphosphates is to reactivate or also to take over the function of adenosin triphosphate that means the use of particularly polyphosphates reinstate the water absorptive capacity of meat after the slaughtering process. The polyphosphates are mainly used in the following product ranges

Comminuted for any kind of minced meat including meat emulsion, cooked cured meat like ham, poultry products like turkey rolls, chicken rolls, any kind of battered and precooked products made of poultry meat, molm etc, seafood like shrimps, fish fillet abalone.

Besides the functionality of polyphosphate it is necessary to select out of the available products with additional properties.

Optimal reaction with muscle protein

Optimal water absorptive capacity

Quick dissolving properties without forming lumps in any kind of solution.

Adjustment in pH value because of taste

Compatability with other additives like organic acid

Due to our experience one single phosphate out of the available selection is not able to fulfill all the properties mentioned before hand. Therefore it is necessary to blend various polyphosphates and that is what we do. Our products also undergo special treatment in our case to instantize this product to give them the best possible solubility.

MEAT EMULSIONS

The meat emulsions consist of very fine particles wrapped in a cover of a muscle protein gel. This protein coagulates during the cooking or smoking process and results at the particular desired texture and bite of a hotdog or frankfurther sausage or any other fine emulsified meat product.

PHOSPHATES IN THE USE OF CURED PRODUCTS LIKE HAM

There is also a big demand for the use of polyphosphate in cooked cured meats, more popular expression of such products are in Asia mainly any kind of hams, it is absolutely essential from a quality point of view as well as from an economic point of view here to bind first of all the natural juice in the meat and also the brine solution which is injected or tumbled into the meat product and it is also absolutely essential that this brine remains in the meat and the cooking loss is limited as much as possible.

To prevent bacteria growth in the meat product it is required to work under low temperature conditions while pumping, curing until the start of the heating process. In modern factories brine solution are kept between 0 celsius and 4 celsius. These rigid conditions make it very often difficult to dissolve the combination of phosphates properly. Undissolved phosphate particles and lumps cannot bind the water of the meat product because of non-availability in the meat and besides that can cause damage and inconvenience in clogging the injection meedles. Therefore highly soluble phosphates, for example curafos 700 instant should be used to avoid those problems.

As a guideline it is understood that the phosphate content in the finished product should be approximately 0.5% because this figure represents the best possible water binding capacity. Extended injection rates above 35－40% requires additional binding properties which can be achieved by the use of hydrocolloids or vegetable proteins or milk proteins. This highly injected products need also additional flavouring and addition of selected food colours.

OTHER APPLICATIONS OF PHOSPHATE IN MEAT PROCESSING

Products made of poultry like turkey, chicken and others tend to be dry after cooking or frying, so it became very common to soak those chicken pieces in a phosphate solution to prevent a too high cooking loss and produce a more juicy and tasty product, it becomes more and more common also to treat breaded poultry products prior to the breading process while soaking it for a short period into a high concentrated phosphate brine, it prevents the separation of water during the deep cooling period and also therefore the breading or batter will stick better to the meat piece in the frying process.

The use of phosphate in precooked products for microwaving afterwards is getting more and more common and is widely experimented.

Not only the meat pieces but also sausages and gravies, particularly gravies containing cheese or caseinate remain in a more attractive condition when using some phosphates to prevent drying out of the product during the microwaving process.

APPLICATION OF PHOSPHATES IN SEAFOOD

A quite popular use of phosphates is the seafood production

TREATMENT OF SHRIMPS

The majority of shrimps which are caught and processed in Asia is still the frozen block of either peeled, headless shell on, or head on shell on. from the time of catching until and during processing the shrimps are losing a considerable amount of their body fluid and a big amount also of minerals and vitamins, the same effect also applies on frozen fish fillet.

Trials conducted in Germany with fish fillet prior to freezing treated with two designed phosphate blends of BK ladenburg and you can definitely see that after thawing this fish fillets remain

in a significantly better quality than untreated ones.

Besides a substantial prevention in drip loss also the loss in protein as well as in vitamin B1 was significantly lower than untreated fish fillets.

The economics of treatment of headless shrimps show the same positive result particularly the cooking loss later on was much lower than a non treated shrimp. This indicated a much juicer and tastier product besides the economic question of having less drip loss or even sometimes some gain in weight.

The processing was done in a shrimp processing plant in the gulf of texas under supervision of the A & M texas university. Besides weight gain, respectively prevention of drip loss. The procedure of mechanically peeling of shrimps could prove in trials in that, by adding a small amount of a phosphate blend solution improves significantly the peelability of raw shrimps. Most of those shrimps are afterwards IQF frozen, and here also the phosphate solution acts as a cryo protectant to prevent freezer burn.

PHOSPHATE BLEND IN SURIMI

In cooperation with a surimi producer in the united state, trials were conducted to prove the significant better gel strength of surimi when using a designed phosphate blend instead of ordinary sodium tripolyphosphate.

The combination of the surimi base plus 0.3% fibrisol 414C has proven to be more outstanding product than defined phosphate blend up to now which was also confirmed in Japan as well.

OTHER APPLICATIONS FOR PHOSPHATE BLENDS

Phosphates are quite suitable to be blended with organic acids. Those blends are particularly designed to extend shelf life and freshness of fillets or other seafood products which get spoiled easily specially during transportation if the refrigeration is not sufficiently cold. The antioxidant comparison shows this effect measured in the increase of TBA (Thiobarbituric acid test) in milligrams per thousand grams treated product.

The last application I want to refer to, is to use polyphosphates, to prevent the formation of struvite, which is chemically a magnesium ammonium orthophosphate. Struvite appears as small glassy crystals. Their appearance are regarded by the consumer as an inferior product.

Magnesium is a trace element in many species of fish, particularly in tuna. The high-polymer phosphate are complexing the magnesium so it will no longer be available for the crystal formation. The tuna or other fish chunks or steaks should be shortly dipped in a 3~4% phosphate solution in addition to a high concentrated common salt brine.

Last but not least phosphates are since a long time known and used in the production of bread, phstrics, pizzas, etc. Generally, partly neutralized phosphates are used in combination with sodium bicarbonate as a leavening system and where the carbon dioxide from the bicarbonate then react with the dough.

In principle this reaction is not very complicated, in practice however the number of process-related parameters make the design of such baking powder very complex. I can say that the release of the carbon dioxide can be controlled by the dissolving properties of the selected phosphate.

An acid sodiumpyrophosphate, for example, one of the most common leavening agent can have different rates of dissolution, depending on the crystalling structure that it had been given. A lower rate of reaction is required for the production of light and viscous types of dough, sponge cakes, and ready to use mixed flour.

An acid sodium aluminiumphosphate for exam-

ple has a slow rate reaction and is particularly suitable for refrigerated raw doughs as those used in pizzas.

Particularly designded phosphates are also used in gelating reactions and antioxidants in juices and pickles and are widely used as mineral enrichment in the form of magnesium and iron phosphates in health food and baby formulas and chocolate drinks.

PHYSIOLOGICAL ASPECTS OF PHOSPHATE ADDITIVES

First of all if we discuss about the physiological importance of phosphate and phosphate related additives it is necessary to mention that phosphates are naturally a part of almost all food stuffs and are mostly chemically related to other substances.

The highest content of phosphates are mainly in meat, fish, poultry, cereal and in vegetable protein.

Phosphate is one of the important parts in the human body, respectively its metabolism.

Approximately 4% of the body weight of an adult person is phosphate. This phosphate is permanently exchanged. Therefore release phosphate has to be replenished continuously through foodstuff.

Approximately 92 up to 95 percent of phosphate contained in foodstuff comes from natural sources. The rest is represented by phosphate containing additives, lecithin and some flavouring agent

The human body uses natural as well as added phosphate in the same way. All phosphate types are absorbed into intestinal parts and released into the metabolism

To determine now the physiological behaviour it is necessary to determine the total phosphate intake.

The FAO-WHO is using for all additives the acceptable daily intake(ADI) to show maximum level for the consumption of additives.

CHART OF ACCEPTABLE DAILY INTAKE

Value 30㎎p/㎏ corresponds to 2100㎎p /person
The acceptable Daily intake for phosphates and phosphorus containing ingredients in the summarized phosphorus-content from
- natural phosphorus-containing ingredients of foodstuffs
- added phosphorus-containing additives e. g. phosphates

Fig. 1. ADI for phosphates and other phosphorus-containing ingredients of foods in expressed as phosporus.

For phosphate additives consequently there is no specific acceptable daily intake of the additive but the value for the total phosphate intake combined of added and natural phosphate expressed as phosphorous

Definition by Expert Committee of FAO/WHO
Definition
The ADI ist the amount of a toxicologicaltested compound, expressed as ㎎/㎏ bodyweight, which can be consumed by a man each day for total lifetime without any risk for health
Prinzip 1% = ADI of no effekt dosis of toxicological evaluation

Fig. 2. Acceptable Daily Intake ADI.

The daily quantities can be determined statistically and you can see they are significantly lower than the acceptable daily intake of approximately 2100 mg p. per person per day. The added phosphorous represented by additives is in the average only 100 mg per person per day. Presumably the phosphate intake out of additives are absolutely non significant and have absolutely no influence on the human body in terms of health or toxicological parameter.

Allowing me to convey again my best wishes to all organisers and guests of the korean society of food and nutrition to achieve during this meeting the success and information you all are looking for. Thank you !