



ADDAPT
Chemicals BV



for tomorrow's
Technology

Foam Control Agents

Processing aids for the
Food/Feed Industry



for tomorrow's

World

The Foamstop™ range

ADDAPT Chemicals BV offers a comprehensive range of Foam Control Agents (FCA) to the food processing industry.

Application		Foamstop™ grade	Details
Sugar production	Sugar beet/ Sugar cane	SIN 360, SIN 365S, SIN 260, SIN 385	Used in all production steps of sugar manufacturing.
Potato processing	French fries	SIN 360, SIN 365, SIN 555	Used during washing and cutting process of potatoes. The natural surfactants and starch create foaming problems.
	Chips	SIN 360, SIN 555	
	Starch	SIN 365, SIN 366, SIN 555	Used during washing, cleaning and concentrating process.
	Fruit water	SIN 360, SIN 365, SIN 555	Used to control foam problems during storage and decantation process.
Fermentation	Alcohol	SIN 260, SIN 360, SIN 365, FSL 16*	Used during fermentation and distillation process of alcohol. * Used as a process aid and cleaning aid during beer production.
	Molasses	SIN 365, SIN 260, SIN 265	Keeps foam at an acceptable level without interfering with the yield of alcohol. Very effective even at low concentrations.
	Amino acid	SIN 365	Very effective even at low concentrations and facilitates smoother pump operation and transport.
	Citric acid	SIN 535, SIN 365	
	Lactic acid	SIN 535	
	MSG**	SIN 535	
	Yeast	SIN 260, SIN 360, F30	Used during fermentation of yeast.
Vegetable processing	Spinach	SIN 555	Very good air release agent which allows smaller packaging.
	Peas/Leek	SIN 388	Used in water bath for cleaning vegetables.
Dairy products	Dairy	SIN 21, SIN 388, FSL 16, FSL 30	Used during whey production/processing and bottling of dairy products.
Meat/poultry/seafood/ egg washing	Meat	SIN 385, FSL 16, FSL 30, FSL 100	Used during meat processing.
	Seafood	SIN 385, SIN 555, FSL 16, FSL 30, FSL 100	Used during cleaning process; to control foam resulting from high salt and protein leaching from seafood.
Animal feed (non EU)	Wet feed/ Mixed fodder	YCA 40	Used to minimize fermentation of Starch and Proteins by Biomass, resulting in higher levels of nutrients in the final feed product.

Temperatures have a strong influence on the FCA activity. Some Foamstop grades are highly effective at specific temperatures as the overview shows.

SIN 360	25°C - 90°C
SIN 366	0°C - 20°C
SIN 385	5°C - 95°C
SIN 388	25°C - 95°C
SIN 555	10°C - 95°C

Notes:

- ADDAPT® Foamstop grades are free of silicones (except FSL-grades).
- ADDAPT® Foamstop grades are Kosher and Halal approved. Certificates are available upon request.
- FCA's used in the food processing industry are processing aids and do not remain in the food unless stated otherwise.

Foam Control Agents

Defoaming, Antifoam and Air release

The food processing industry battles three different features:

- **Defoaming** of the foam bubble
- **Antifoam** (prevention of foam bubbles)
- **Air release** (removing of gases from the liquid medium)

Defoaming

Foam bubbles can be destroyed with thermal and mechanical methods. However these methods are not practical and can have a major influence on the substrate. Mechanical methods go hand in hand with high installation costs and permanent running costs, which are undesirable. For this reason the chemical method is an attractive and cost effective choice to battle foam.

The advantages:

- Low costs (pumps and pipelines);
- Very effective;
- Besides defoaming, foam preventing is also possible.

Air release

Foam formation occurs when air or gas is present in the liquid. Therefore, many formulators or end-users use a so-called 'air release agent'. The air release agent transforms small air bubbles into bigger ones so they can rise to the surface more rapidly. In case the liquid contains surface active components (surfactants), air bubbles that reach the surface are stabilised and foam is created. If the liquid does not contain any surfactants, no foam will be formed and the air bubbles will collapse immediately at the surface, the liquid being completely de-aerated. Air can again be mixed into the liquid by a chemical reaction or by strong agitating process. Typical air release agents are: solvents (kerosene), silicones and mineral oils with silica.

Types of FCA's

The industry supplies a wide range of different foam control agents. The most widely known classes of FCA's are:

- Silicones
- Dimethyl Polysiloxanes (and their polyether modified grades)
- Mineral oil based grades (modified with silicates)
- Poly Alkylene Glycols (PAG)
- Esters (fatty acid initiated or poly alcohol initiated)
- Solids (powders)
- Combination of compounds as shown above

Foam control agents for the food industry requires FDA approved grades, for this reason, not every type of FCA can be applied. The sugar, potato, yeast and starch industries use mainly Ester and PAG based FCA's.

FDA regulations

The Code of Federal Regulations volume 21; parts 170 to 199 lists all chemicals that are allowed to be used as FCA in food processing (direct or indirect food contact).

Normally this list is also the guideline during developmental work in order to ensure the final product is in accordance with FDA regulations (Food and Drug Administration, Department of Health and Human Services, USA).

FDA paragraph	Class of compound	Application
172.810	PAG, Esters	Fruit juice and dry beverage
172.310	PAG	Boiling water additive
173.340	PAG, Esters, Siloxane	Food processing
175.105	PAG, Ester, Mineral oil, Siloxane	Adhesives
176.180	PAG, Ester, Siloxane	Paper and paperboard (food contact)
176.200	PAG, Ester, Mineral oil, Siloxane, Silicone	Coatings
176.210	PAG, Ester, Siloxane, Mineral oil	Paper and paperboard (manufacturing)
178.1010	PAG, Ester	Sanitising solutions for food processing equipment

Sugar industry

Sugar is obtained from two different raw materials: sugar beet and sugar cane. Europe produces mainly sugar beet while South Africa, Brazil, Mauritius, Australia harvest sugar cane.

Sugar processing requires different defoamers; the choice depends strongly on the stage of the sugar process. ADDAPT® Foamstop SIN 360 and SIN 365S are the most recommended grades for the extraction and evaporation process. ADDAPT® Foamstop SIN 365 is recommended to minimize foam formation during the fermentation process of molasses.



Sugar beet

Processing sugar beet includes washing and transportation of the beets, which (in case of a closed waterway) leads to strong foam formation. These waterways are normally foam controlled by usage of ADDAPT® Foamstop SIN 360 and ADDAPT® Foamstop SIN 365S.

Sugar Cane

Sugar canes are not washed nor transported by waterways. Foam control agents are required in the extraction and clarification processes. ADDAPT® Foamstop SIN 360 and SIN 365S are usually recommended.

Recommended Foamstop grades:

ADDAPT® Foamstop SIN 260, SIN 360, SIN 365S and SIN 385.

Potato industry

It is estimated that the industry uses over 400 million tons of potatoes every year (world consumption). Besides the consumption of potato as food, potatoes are raw materials for the alcohol and starch production. A study showed that 30% of the potato is consumed as chips and potato, 10% is used as seeds, 50% is sold as cattle feed and only 5% finds its way in distilleries and starch applications.

Foam control agents are used in industrial processes where potatoes are converted into other foodstuffs. The FCA's are needed in the production processes of for example French fries, crisps and chips. Treat levels strongly depend on the cultivation of the potato, soil structure, process temperatures and climatic conditions. The total amount of processed potatoes remained at a constant level for the past 25 years, however the use of FCA's has increased because of improved processing methods with more extensive extraction of components such as starch and protein.

Potato structure

Potatoes come in different sizes, shapes and colours. Their composition varies strongly depending on their origin, but in general it can be said that an average potato contains the following components:

Component	Content (%)
Water	75.0
Starch	20.0
Total sugar	5.0
Raw protein	2.0
Pulp	1.0
Total ash	1.0
Fat	0.4

The foam active ingredients are starch and protein. The ash contains potassium, phosphate, sodium, calcium, magnesium, iron, chlorine and a residue of vitamins C, B1 and B2.

Potato processing

The pre-cleaning of the potatoes usually starts during the unloading process. The main cleaning process happens in 'washing machines' similar to those used in the sugar industry. The potatoes are immersed in water and stirred thoroughly by iron bars. This cleaning process removes all dirt and peels the potatoes partially. Washing water flows against the potato stream and afterwards the water is pumped into the settling ponds where solids start to separate.

The cleaned water is being circulated and some fresh water is added in order to keep the original amount of water. Processing a ton of potatoes requires 2 - 3 m³ water. The washing water is reused and over time this water contains so much starch and protein it will start to foam. Usage of a FCA is necessary at this stage.

Recommended Foamstop grades:

ADDAPT® Foamstop SIN 360, SIN 365 and SIN 555.

These Foamstop grades all have the following product properties:

- Low viscosity;
- Low solidification point (low pour point);
- Good cost/performance balance.

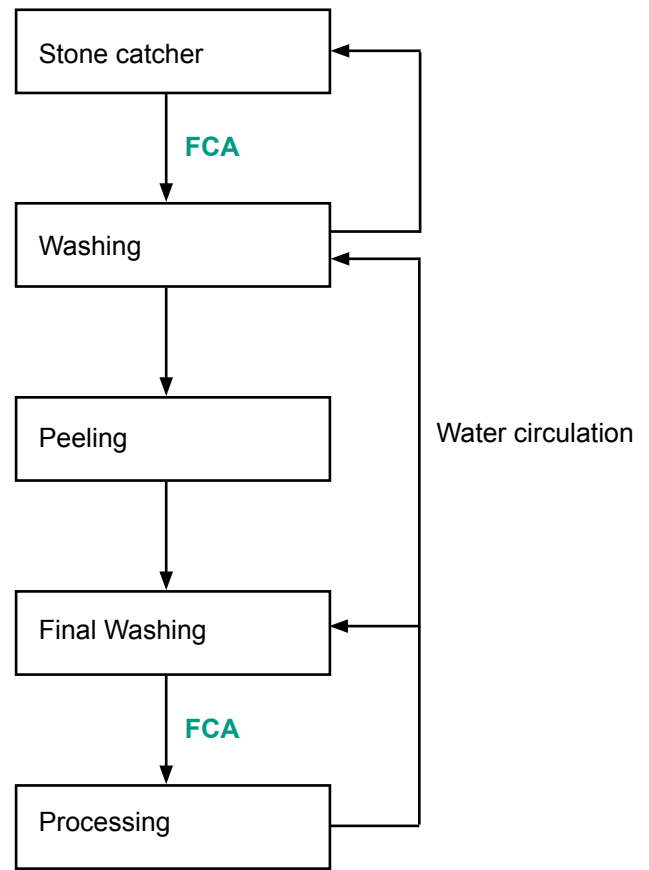
Treat levels depend on various process conditions such as:

- Volume of the water ways (water circulation)
- Volume of fresh water added to the circulation water
- Volume of the sludge
- Potato quality (starch & protein content)
- Contamination of the potato (soil)
- Condition of potato (exposed to very low temperatures or not)

Foamstop SIN 555 is normally used for quantities of 10 - 40 g/ton of potato.

However, frozen potatoes do lead to strong foaming properties. The low temperature converts the starch to sugar, leading to strong foam formation. Therefore, frozen potatoes usually require FCA at 100 g/ton potato (3 - 4 times higher).

Washing process



Chips

Potato chips (crisps in British English) are commonly served as a snack and consumed at large quantities throughout the world.

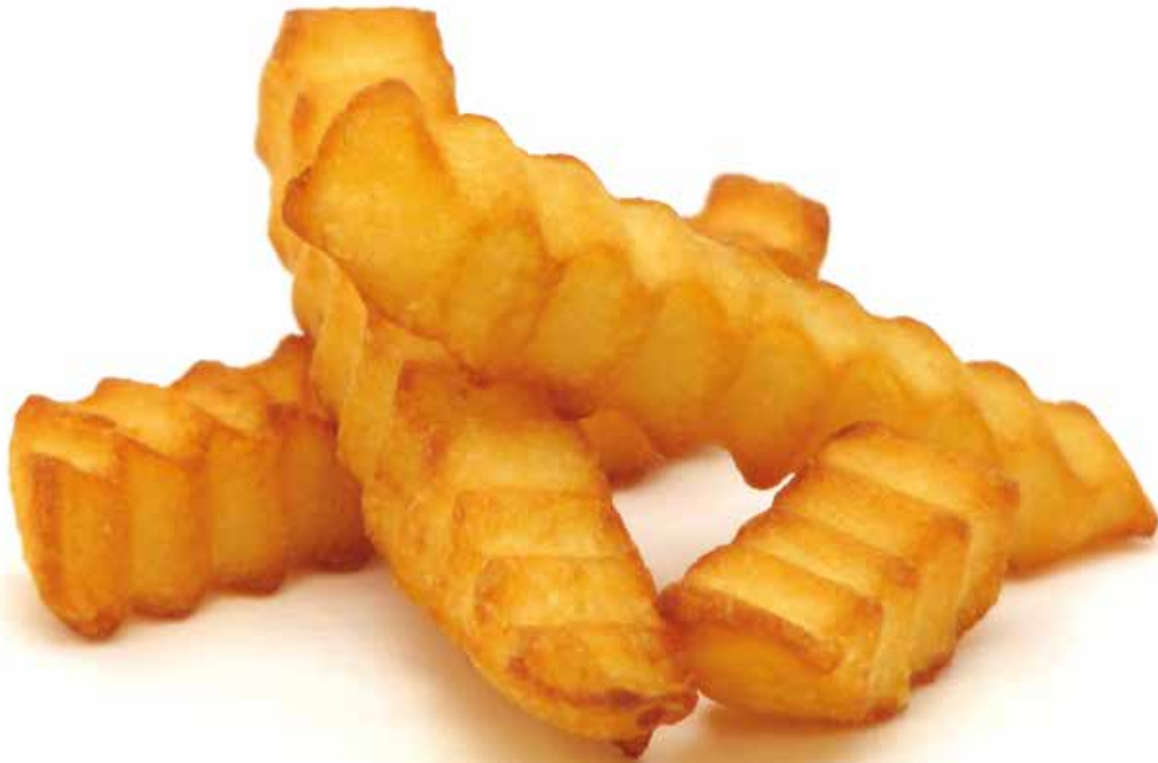
Carborundum peelers are mainly used for the production of chips (other methods have a negative impact on the appearance of the final product). After the potatoes are peeled, a rotating disk cuts them into slices. During this cutting process starch is released into the water, causing foam formation which can negatively affect crisp production efficiency. Afterwards, the chips are dried, blanched, fried, flavoured and packed.

FCA's are used during the washing and cutting process of potatoes. In cases where a lot of fresh water is used, a FCA is not required. However, there still is foam formation at the point where the water leaves the washing cylinder. At this point it is recommended to add a FCA to the water (dosing point). In some cases the end-user adds a FCA directly to the washing and slicing machine in order to prevent foam formation.

Recommended Foamstop grades:

ADDAPT® Foamstop SIN 360 and SIN 555. Recommended dosage level is 20 - 70 g/ton potato.

Note: Silicones containing foam control agents should be avoided as they have the tendency to clog up starch.



French fries

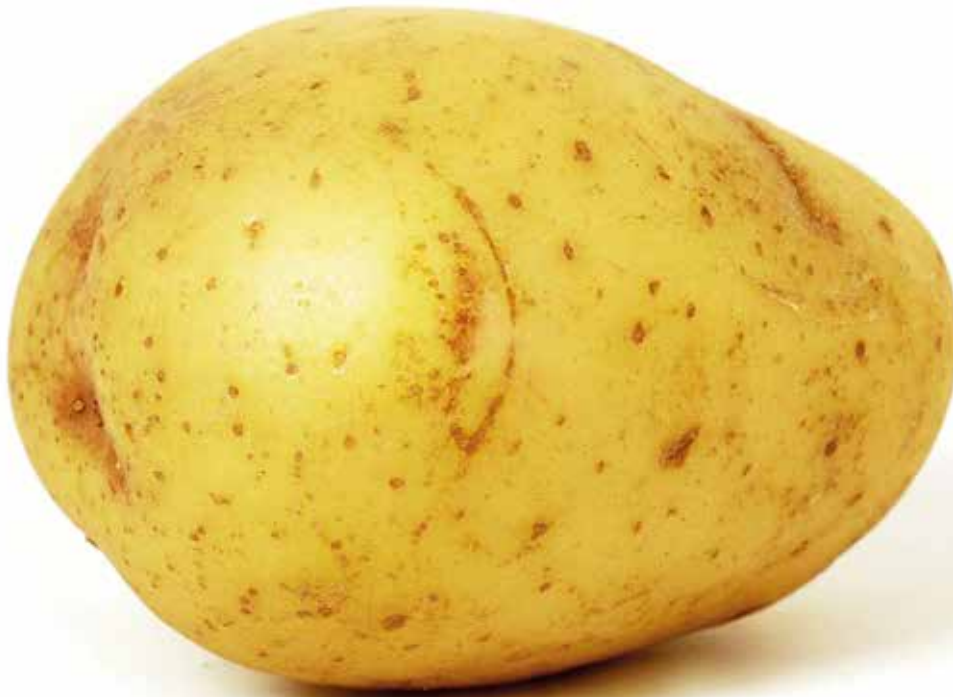
French fries were introduced to the market just after World War II. The production of French fries is very similar to the production of chips, only their shape differs. Cutting machines cut the potatoes lengthwise. After they are cut the fries are sorted, washed, blanched and finally cooked and/or frozen.

During the cutting process, the potato is pressed through cutting knives using high water pressure. The water and cut potato are then separated from each other so the water can be reused. However, after a period of time the water gets saturated with active ingredients causing foam formation. The high water pressure requires (almost) no air to be entrapped in the water and no foam on the surface of the water, as it will have negative effect on the cutting process. In this case the foam control agent must exhibit anti-foaming properties as well as air release properties.

Recommended Foamstop grades:

ADDAPT® Foamstop SIN 360, SIN 365 and SIN 555.

These Foamstop grades for the potato chips production have excellent air release properties. Dosage level is between 20 - 70 g/ton potato. The temperature of the processing water has a strong influence on the FCA activity. ADDAPT® Foamstop SIN 360 is highly active at temperatures between 25°C and 95°C.



Starch

The pulping process takes place in large rotating cylinders containing many saw-blades. During this process the potato is crushed or cut in order to make starch extraction easier. The mashed potato is a medium viscous liquid, also called “ground potato”. Water containing sulphur dioxide (SO₂) is added to the ground potato to avoid colonisation (melanine) and to improve pumpability. Repeated washing (cold water) extracts the starch from the mashed potatoes. The final pulped potato has little starch left and is used as cattle feed (mixed fodder)*.

The remaining ‘starch milk’ is washed with water by using nozzle separators or hydrocyclones. Washed fibres as well as washing water are fed back into circulation. Finally the starch milk is concentrated and thickened by centrifuge (vacuum rotary filters) and dried in drying drums.

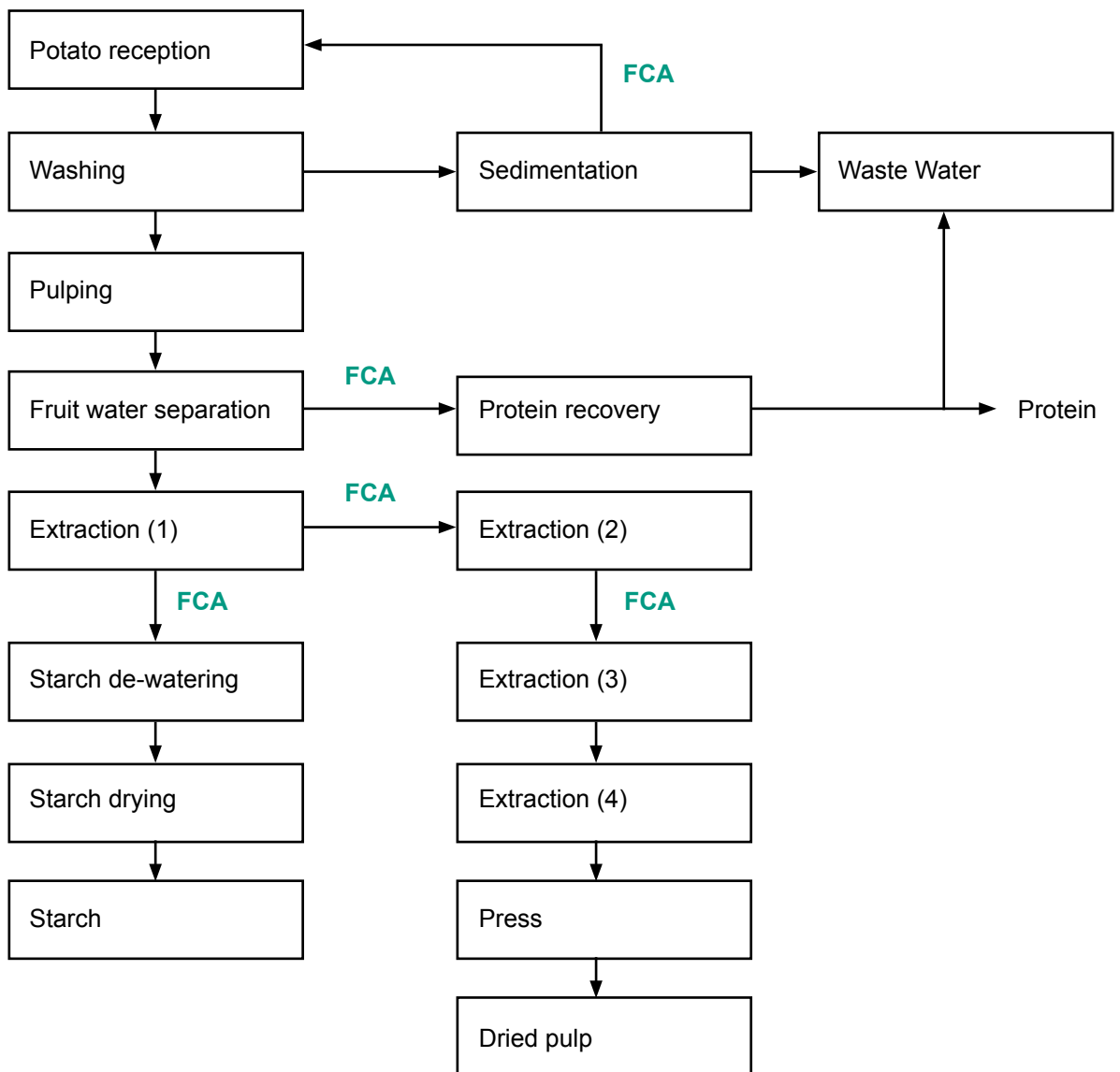
FCA’s are used in the wet starch area. Foam occurs in areas where pumps are in use (washing/cleaning/concentrating). At these points, dosage pumps are installed to control foam formation.

Recommended Foamstop grades:

ADDAPT® Foamstop SIN 365, SIN 366 and SIN 555. Dosage levels are between 10 - 75 g/ton potato.

** For more information on Yeast Control Agent for animal feed ‘ADDAPT® YCA 40’, see page 10.*

Starch production



Fruit water

The “ground potato” decanters separate the fruit water from the potato. Because of restricted sewage regulations, it is not allowed to sprinkle all fruit water. For this reason many starch factories collect the fruit water. The protein is separated from the fruit water and the remaining fruit water is evaporated and pumped to the biological purification plant.

The concentrated fruit water is a very foam active medium. The foam causes problems during storage and the decantation process. A Foam Control Agent is added to the fruit water in order to control the foam. Typical dosing points are behind the decanter and (in some cases) in front of the decanter.

Recommended Foamstop grades:

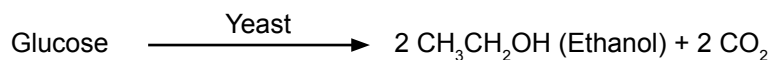
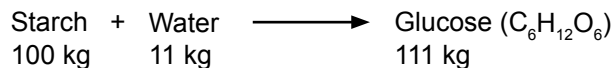
ADDAPT® Foamstop SIN 360, SIN 365 and SIN 555. Typical treat levels are between 20 - 70 g/m³ fruit water.

Fermentation process: Alcohol

Potatoes can be used for the production of alcohol. Authorities determine the type and amount of the raw material as well as the capacity and number of distilleries. The alcohol industry differs from country to country. Compared to other raw materials used for the alcohol production, potatoes are the most foam intensive raw material during alcohol production. FCA's are therefore required in the waterways (in the flumes and the washing water).

The process

Potatoes are first pulped and steamed. The starch is converted to glucose as soon as an enzyme is added. The glucose is pumped into a fermenter. Yeast is added to the glucose and the glucose will be fermented into alcohol and carbon dioxide (CO₂) within 48 hours.



The formation of carbon dioxide leads to (undesired) foam generation. Usage of FCA's is essential to control the fermentation reaction and to avoid overflow of the fermenter. Large fermenters are equipped with automatic dosing systems, i.e. a probe determines the height of the foam collar and as soon as the foam reaches a certain level, a small amount of FCA will be released into the vessel.

When the fermentation process has been terminated, the reaction mixture (mash) contains about 9% ethanol. The ethanol is distilled and the final yield is 93% pure ethanol.

The distillation process can also cause foam formation. Normally the amount of FCA added to the fermentation process should be enough to reduce or even prevent foam formation during the distillation process. In case foam formation still occurs during distillation process, an extra dosage of the same FCA is recommended.

Recommended Foamstop grades:

Recommended FCA's for the fermentation and distillation process are ADDAPT® Foamstop SIN 260, SIN 360, SIN 365 and FSL 16. The dosage levels vary between 20 - 50 g/cm³ mash.

Animal Feed: Yeast Control Agent

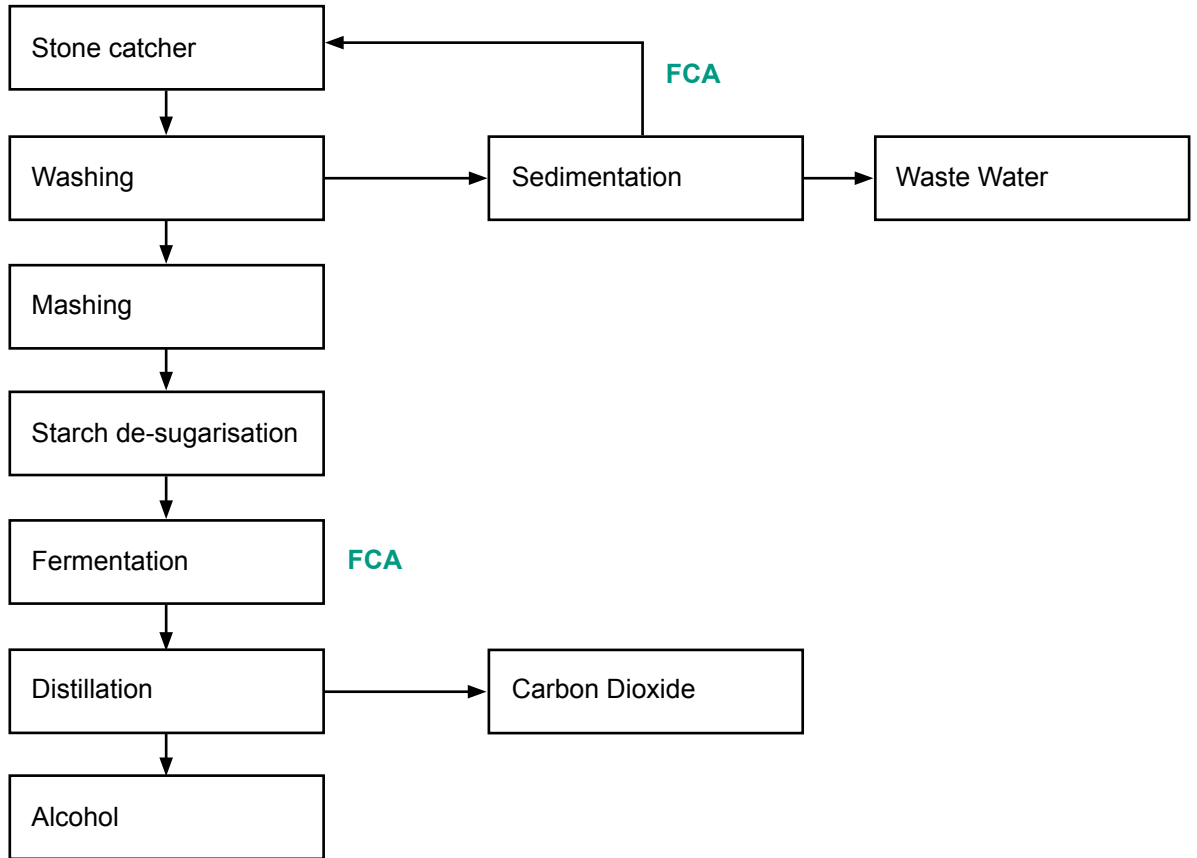
The fermentation of starch and proteins by so-called 'Biomass' (i.e. bacteria and yeast) will lead to products with lower nutritious value. This fermentation process also causes foam formation and a strong release of gasses and odour.

Yeast control agent **ADDAPT® YCA 40** is recommended as it inhibits growth of 'Biomass' and suffocation of 'Biomass' by deaeration.

ADDAPT YCA 40 exhibits the following advantages:

- Decreases/stops the activity of 'Biomass'
- Ensures higher nutritious value of feed
- Lowers the odour of fermentation (less smelly food)
- Ensures higher feed uptake by animals (growth: piglets 50-70 grams/day)
- Diminishes gas formation by animals
- Low dosage (100 ml/m³ feed/mixed fodder) - easy to emulsify.

Alcohol production



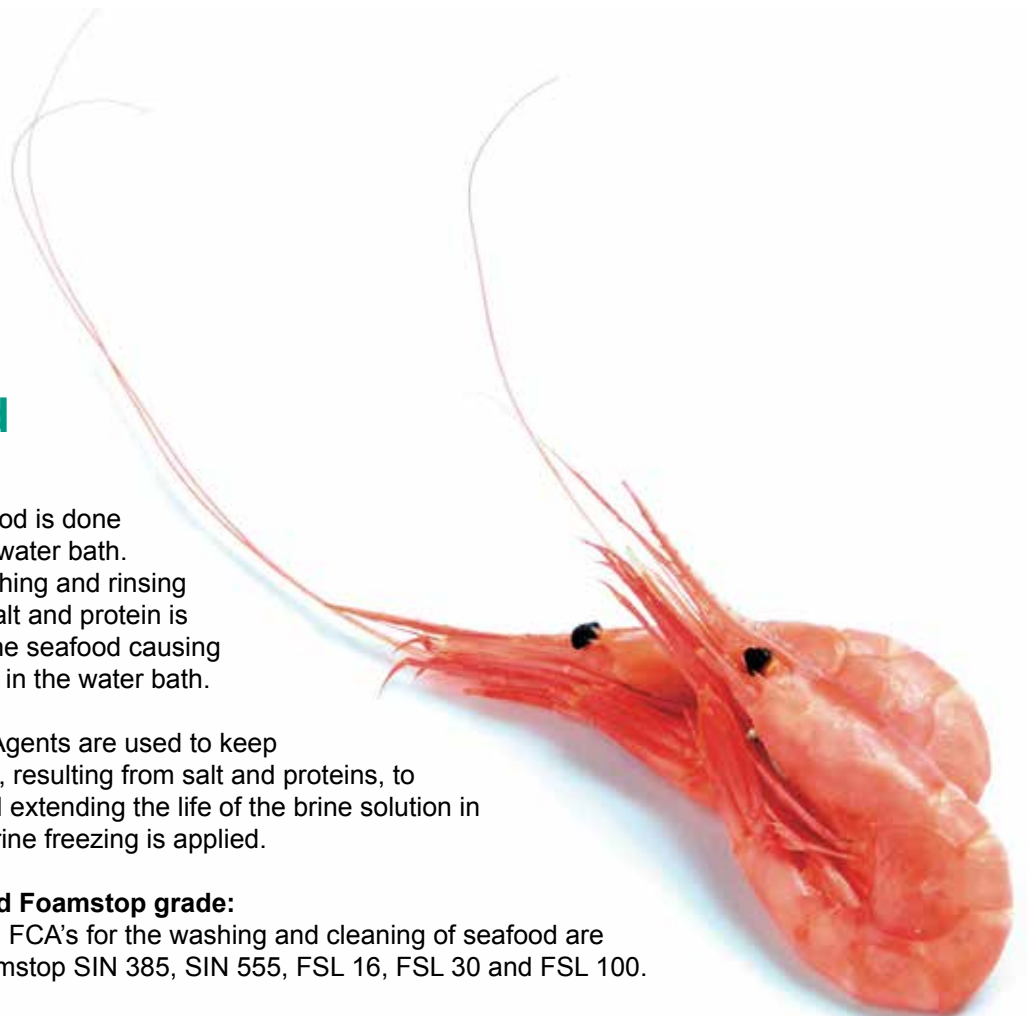
Seafood

Cleaning seafood is done by means of a water bath. During the washing and rinsing process high salt and protein is leached from the seafood causing foam formation in the water bath.

Foam Control Agents are used to keep foam formation, resulting from salt and proteins, to a minimum and extending the life of the brine solution in cases where brine freezing is applied.

Recommended Foamstop grade:

Recommended FCA's for the washing and cleaning of seafood are ADDAPT® Foamstop SIN 385, SIN 555, FSL 16, FSL 30 and FSL 100.



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