

### c) Listing of Feed Materials

Feed materials from the starch industry meet the statutory definitions of raw materials (Regulation 68/2013 definitions). However, the composition of marketed products may differ, depending on production sites, production tools and processes, and market opportunities.

The following list is a non exhaustive list of the main products of the starch industry intended for use as feed materials by feeding stuffs producers; the definitions below are extracts from Regulation 68/2013 (taking into account industrial language).

Name	Number	Description
○ Maize gluten	1.2.8	Product of the manufacture of maize starch. It consists principally of gluten obtained during separation of starch.
○ Maize gluten feed	1.2.9	Product obtained during the manufacture of maize starch. It is composed of bran and maize solubles. The product may also include broken maize and residues from the oil extraction of maize germs. Other products derived from starch and from the refining or fermentation of starch products may be added.
○ Maize germ meal	1.2.12	Product of oil manufacture, obtained by extraction of processed maize germ
○ Wheat Feed	1.11.6	Product of flour or malting manufacture obtained from screened grains of wheat or dehusked spelt. It consists principally of fragments of the outer skins and of particles of grain from which less of the endosperm has been removed than in wheat bran.
○ Wheat gluten feed	1.11.16	Product of the manufacture of wheat starch and gluten. It consists of bran, from which the germ may have been partially removed. Wheat solubles, broken wheat and other products derived from starch and from the refining or fermentation of starch products may be added.
○ Vital wheat gluten	1.11.18	Wheat protein characterised by a high viscoelasticity as hydrated, with minimum 80 % protein (N × 6,25) and maximum 2 % ash on dry substance
○ Potato pulp	4.8.8	Product of the manufacture of potato starch consisting of extracted ground potatoes.

- Potato pulp, dried 4.8.9 Dried product of the manufacture of potato starch consisting of extracted ground potatoes.
- Potato protein 4.8.10 Product of starch manufacture composed mainly of protein substances obtained after the separation of starch.
- Potato juice, concentrated 4.8.14 Concentrated product of the manufacture of potato starch, consisting of the remaining substance after the partial removal of fibre, proteins and starch from the whole potato pulp and evaporation of part of the water.
- Pea protein 3.11.9 Product obtained from the separated pea fruit water when producing starch, or after grinding and air fractionation, maybe partially hydrolysed.
- Pea solubles 3.11.11 Product obtained from starch and protein wet extraction from peas. It is mainly composed of soluble proteins and oligosaccharides.
- Pea fibre 3.11.12 Product obtained from the separated pea fruit water when producing starch, or after grinding and air fractionation, maybe partially hydrolysed.
- Starch mixture 13.3.3 Product consisting of native and/or modified food starch obtained from different botanical sources.

The above list will be amended, if appropriate, in function of industrial developments within the starch industry, or of an evolution of the EU legislation on feed materials like e.g. a review of the Catalogue of feed materials.

The above list is non exhaustive. Other raw materials (e.g. barley and rice) and other feed materials (that can be specific to a plant or based on market demands) and all food ingredients sold also as feed materials, are considered to be within the scope of the EFISC Code. For all products sold as feeds materials a risk assessment in line with annex 3 needs to be available.

The exact compositions of marketed products sold to the feeding industry can be found in the marketing documents (data sheets) of each starch producer.



## d) Overview of the main processes

The below manufacturing diagrams are basic schemes (i.e. examples) for the production of starch from wheat, maize, potato and pea, yet every production site may present distinctive features.

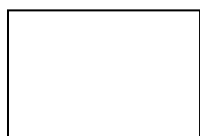
Specific feed materials are underlined in the flow charts. However all other products except ethanol can be used both for feed and food.

They must not be regarded as a standardized process to be applied by starch companies. Each company remains free to decide what design each industrial processing unit should look like.

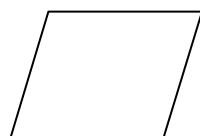
### Symbols



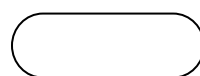
Main Process



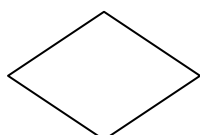
Process step



Material



Process start or terminator



Decision

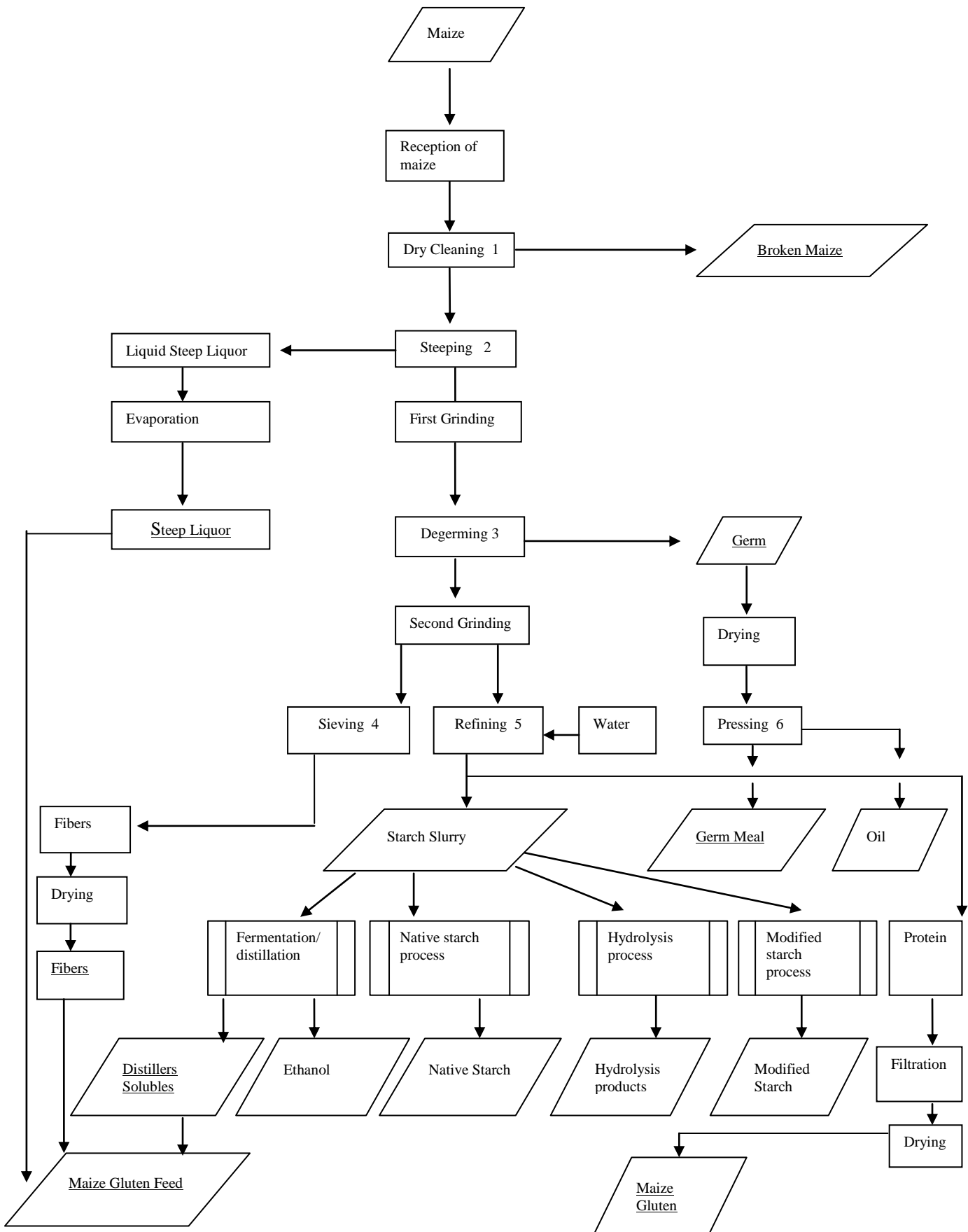


## 1. MANUFACTURE OF MAIZE STARCH

1. Dry cleaning: sieving and sucking up of impurities and broken grains. The parts non suitable for feed use are eliminated. The parts suitable for feed use are sold as such or incorporated in corn gluten feed.
2. Steeping: corn put into water in order to separate the soluble components (= liquid steep liquor). Micro-organism controlling agent is added to prevent from bad fermentation.
3. Degerming: germ separated from the grain thanks to density difference going through a cycloning.
4. Sieving: product goes through a sieve. Fibres particles stay on the sieve / slurry made of starch and protein goes through.
5. Refining: starch separated from protein thanks to density difference going through a centrifugal extractor.
6. Pressing: oil separated from germ thanks to mechanical pressure.



# 1. MANUFACTURE OF MAIZE STARCH - BASIC SCHEME

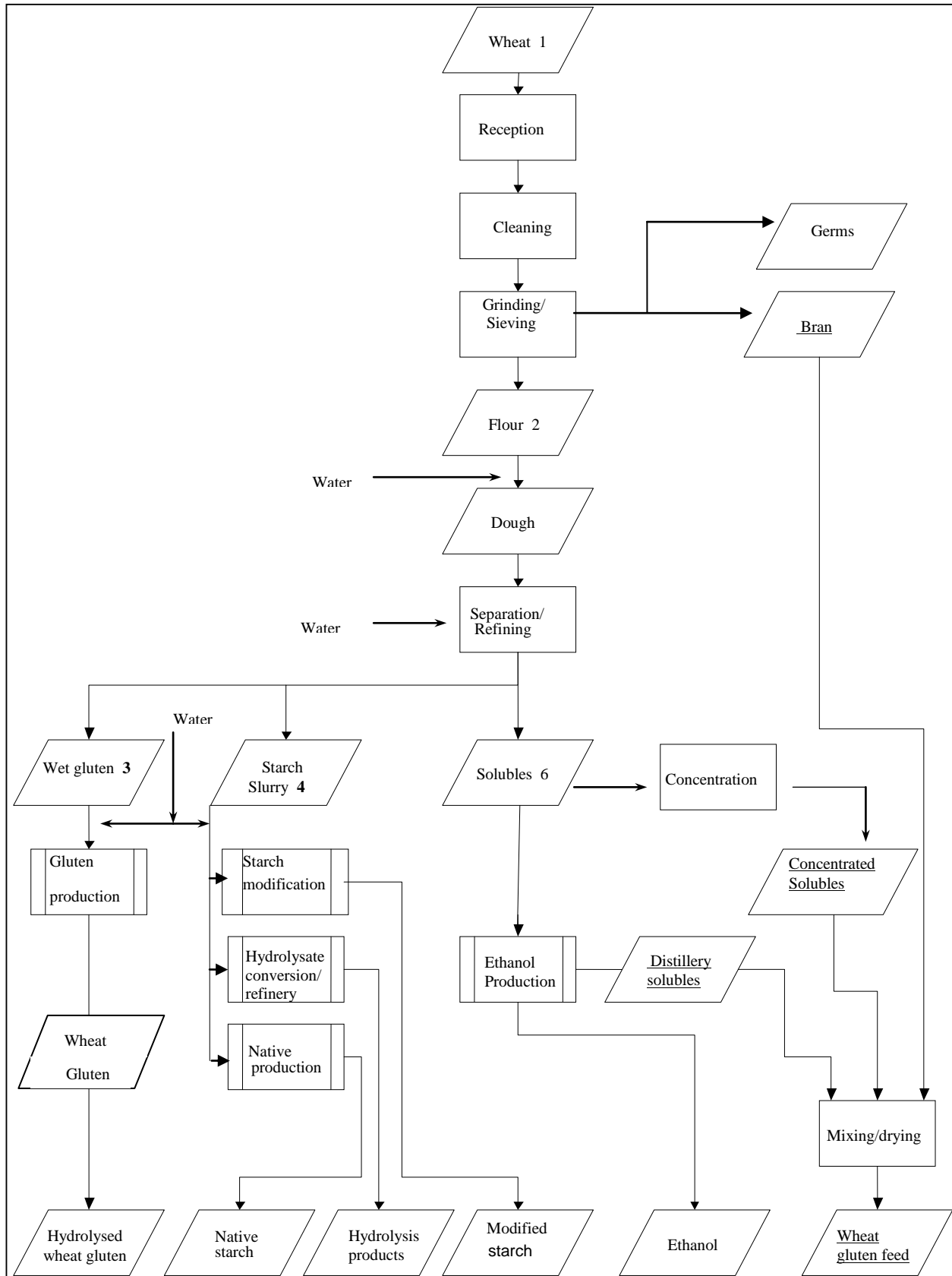


## 2. MANUFACTURE OF WHEAT STARCH

1. The incoming wheat is cleaned and ground to flour. The wheat bran and eventually also wheat germ are separated from the flour by sieving.
2. The flour is mixed with water to form a dough and the starch and gluten are separated by a physical process.
3. The wet gluten is washed with water to remove residual starch and dried to wheat gluten. The wet gluten can be partially hydrolysed also to produce hydrolysed wheat gluten.
4. The starch slurry is washed with water and can be:
  - Dried to produce native wheat starch;
  - Physically and/or chemically modified and dried to produce modified wheat starches;
  - Hydrolysed by acid hydrolysis and/or enzymes to produce a range of starch hydrolysis products.
5. A fraction of the starch separated during washing can be used in animal feed (liquid wheat starch) or in ethanol production (not shown in the flowdiagram).
6. A fraction of solubles from the separation of starch and gluten can be used in alcohol production, or concentrated and used as such in animal feed (wheat solubles) or added to the wheat bran to produce wheat gluten feed.
7. In ethanol production the starch is enzymatically hydrolysed to sugars and fermented to ethanol with yeast. The ethanol is separated by distillation, and the remaining solubles are concentrated and either used as such in animal feed (distillery grains and solubles) or added to the wheat gluten feed.



## 2. MANUFACTURE OF WHEAT STARCH - BASIC SCHEME



### 3. MANUFACTURING OF POTATO STARCH

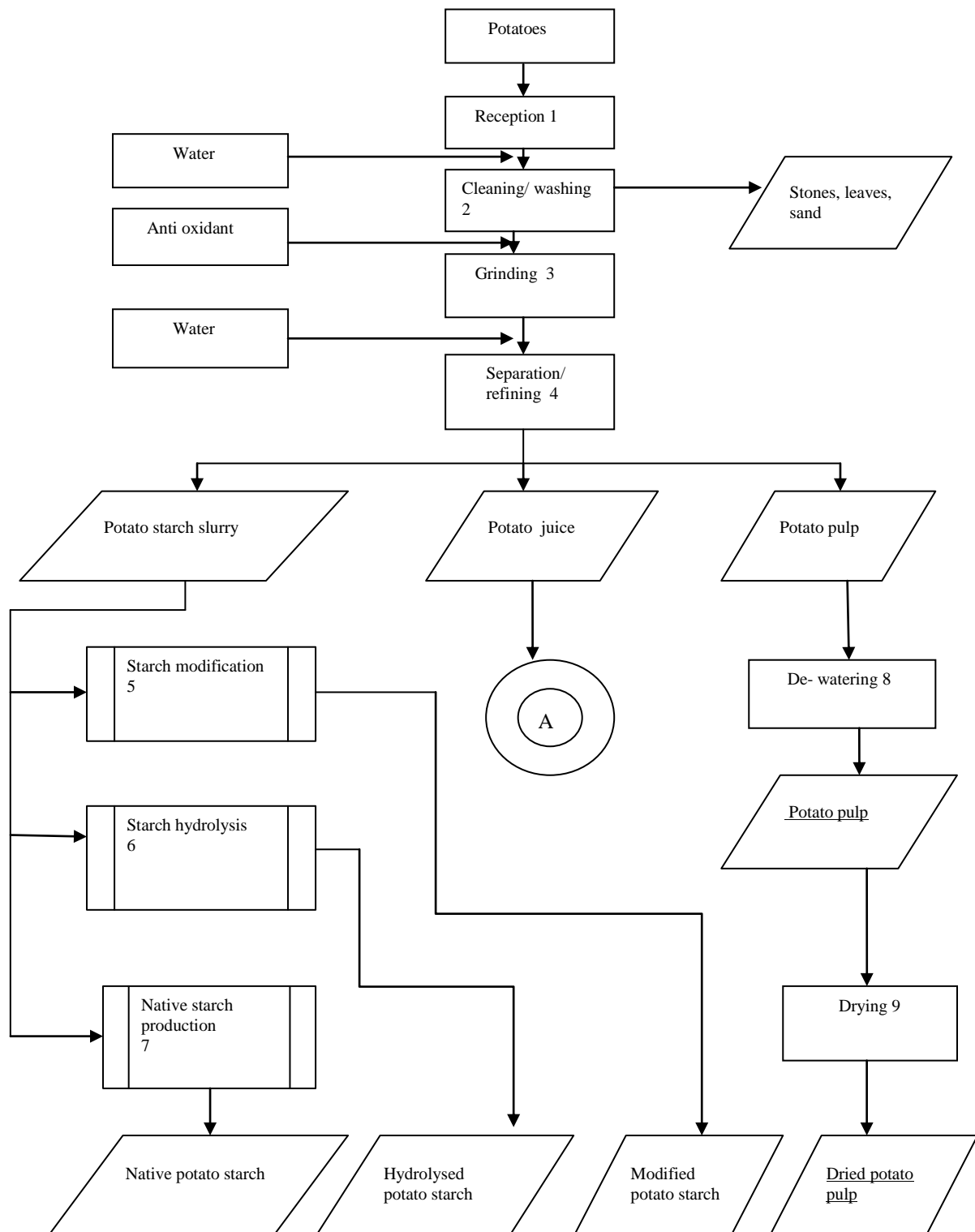
1. At the reception of the potatoes a sample is taken to check on quality.
2. The potatoes are washed and unwanted components like sand, leaves and stones are removed. To prevent excessive foaming some food grade anti foam is added.
3. The cleaned potatoes are grinded and anti oxidant is added.
4. The grinded potatoes are separated with gravity based techniques to potato starch slurry, potato juice and potato pulp.
5. The starch slurry is modified by chemical and/or physical techniques and dried to modified starch.
6. The starch slurry is hydrolysed with acid or enzymes and dried to hydrolysed starch.
7. The starch slurry is de-watered and dried to native potato starch.
8. The potato pulp stream is de-watered mechanically to the feed product potato pulp.
9. The regular potato pulp product can be dried further to dry pellets – dried potato pulp.
10. The potato juice is heated with steam and the protein components coagulate. To prevent excessive foaming some food grade anti foam is added.
11. The coagulated protein is separated by gravity techniques from the potato juice.
12. The protein is dried to the feed product potato protein.
13. Potato protein is mixed with water and acid for the production of potato protein (purified).
14. The mixture of water and coagulated protein is refined to remove the natural glyco alkaloids from the protein.
15. The refined protein is dewatered by gravity techniques.
16. The refined protein is dried to the feed product potato protein (purified).
17. The potato juice is heated to evaporate water and produce condensed potato juice.

The pH is checked and corrected by pH Regulators in various stages of the production process.

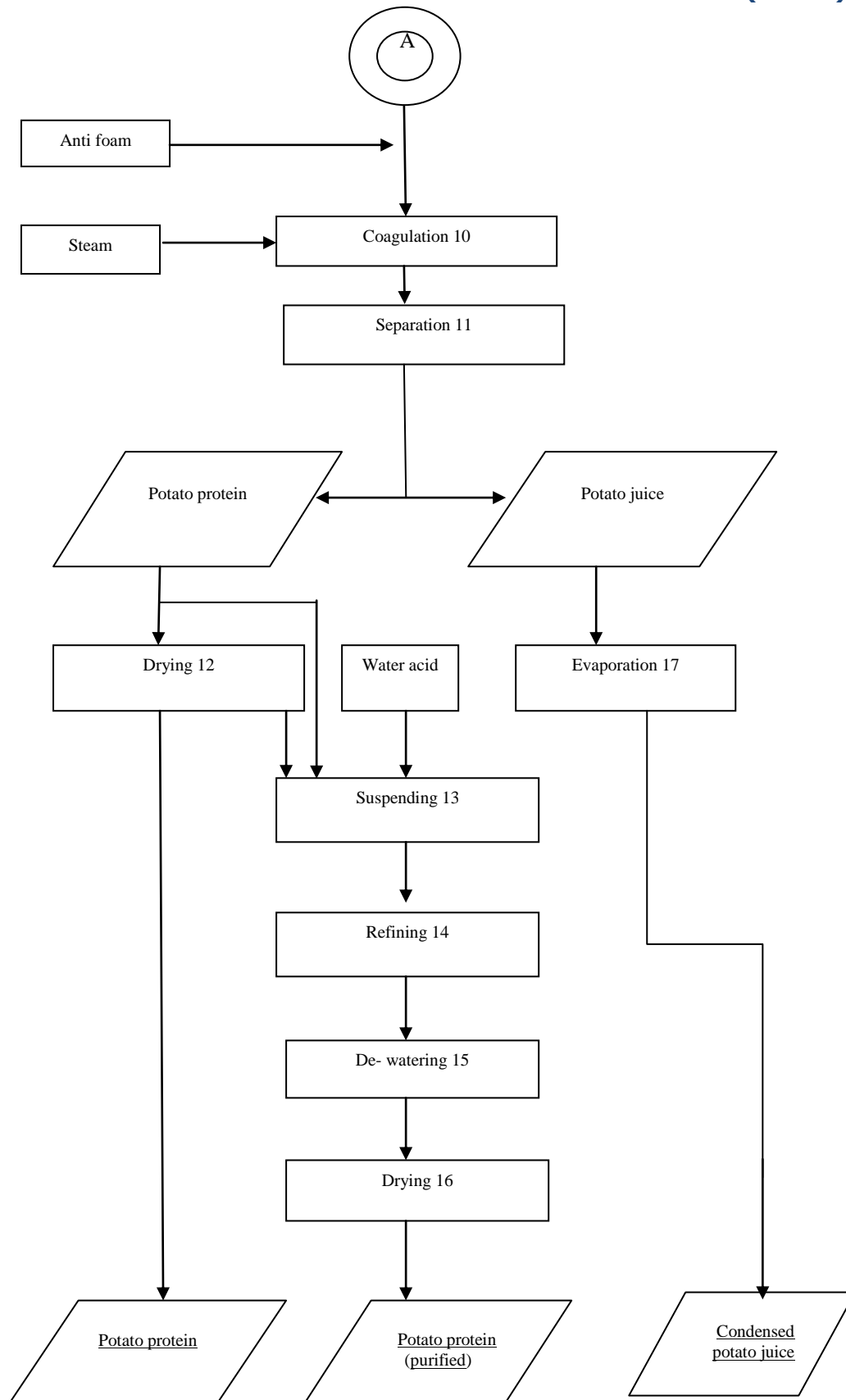




### 3. MANUFACTURING OF POTATO STARCH - BASIC SCHEME (1 of 2)



### 3. MANUFACTURING OF POTATO STARCH - BASIC SCHEME (2 OF 2)



#### 4. MANUFACTURING OF PEA STARCH

1. The incoming dry pea is sampled to check the quality.
2. Pea is cleaned to remove impurities and broken pea by sieving.
3. The cleaned peas are grinded / sieving to flour.
4. The flour is mixed with water to separate by physical process to pea starch slurry, pulp and liquid protein products.
5. Pea pulp fraction is de-watered mechanically to the feed product pea pulp.
6. The pea starch slurry is washed and can be :
  - dried to produce native pea starch,
  - physically and/or chemically modified and dried to produce modified pea starch.
7. The pea protein liquid is heated with steam and the protein components coagulate.
8. The coagulated protein fraction is separated by gravity techniques from pea protein liquid.
9. After coagulated protein fraction separation, the liquid fraction is heated to evaporate water and produce condensed pea soluble.  
The pH is checked and corrected by pH regulators in various steps of the production process.
10. The pea protein fraction is dried to obtain pea protein product.



#### 4. MANUFACTURING OF PEA STARCH - BASIC SCHEME

