

THE POSSIBILITIES OF PRODUCING CORN STARCH IN ORMOŽ

(Conceptual Design)

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Ormož, March 2018.

1. Introduction

In 2006, the EU sugar sector reform effected the closing of over 90 sugar factories, among them also Tovarne sladkorja d.d. in Ormož (hereinafter TSO).

The location of the former TSO has remained empty and is appropriate for some other type of production. The infrastructurally very well-equipped location is highly suitable for the food-processing industry, as the entire infrastructure was devised for food-processing.

One of the possibilities is to install the production of corn starch at the location. The purpose of this document is to provide the basic description of the possibility of such production in Ormož in terms of informing potential investors.

2. What is starch

Starch (lat. Amylum) is a complex carbohydrate, more specifically a polysaccharide (= Vielfachzucker), composed of a large number of linked glucose molecules (= simple sugar). Corn, wheat and, for example, tapioca plants store energy in the form of starch, i.e. Glucose molecules. The state of matter is solid - dust, the melting point is at 250 °C.

When heated with diluted acids or under the influence of enzymes, it dissolves into dextrin, then maltose and finally into glucose.

In starch production, the following products can be produced:

- Starch;
- Modified starch (many kinds of modified starch);
- Gluten;
- Animal feed;
- Sweeteners (isoglucose);
- Substrates for the production of bioenergy and natural fertilisers.

3. The usability of starch

Starch is one of the most important industrial products with a broad range of utilisation areas. It is used for nutritional and non-nutritional purposes. Approximately 65% of starch is used for nutritional purposes and 35% for non-nutritional purposes.

In nutrition, starch is used in the following fields:

- Food products;
- Sweets and syrups.

For non-nutritional purposes (industrial purposes), starch is used in the following industrial fields:

- Paper and carton industry;
- Pharmaceutical industry;
- Chemical industry;
- Construction.

4. Quantities and importance of starch worldwide and in the EU

Cca. 75.9 million tons of starch is produced worldwide, thereof 44% corn starch, 24% tapioca, 5% potato, 4% wheat and 22% dextrin and other modified starches.

In the EU, 24 companies in 78 factories produce cca. 10 million tons of starch. The total production value is 8.8 billion EUR. 15,600 people are directly employed in the branch; another 100,000 workers are employed indirectly. In the EU, around 22 million tons of agricultural products is processed into 10 million tons of starch and 5 million tons of by-products.

The base materials for starch production are 35% corn, 35% wheat and 30% potatoes. Corn starch is gaining in importance, as its further processing provides many other options.

Experts estimate an annual 2% growth of starch usage, making production highly prospective in the future.

The most important starch producers in the EU are:

- Cargil-Cerestar - 28% market share;
- Roquette - 20% market share;
- Syral - 15% market share;
- Tate & Lyle - 7% market share;
- Agrana - 6% market share;
- Avebe – 6% market share;
- Others - 18% market share.

The quantities of raw materials processed into starch are as follows:

- Corn cca. 8.8 M tons, starch from corn cca. 4.8 M tons;
- Grain cca. 8.0 M tons, starch from grain cca. 3.9 M tons;
- Potatoes cca. 6.0 M tons, starch from potatoes cca. 1.3 M tons.

In total, 22.0 M tons of raw material or 10 M tons of starch.

This shows that the production of starch is extremely important for the development of agriculture in individual countries, as the industry is a large buyer of agricultural products. Thus, the starch industry is also a large-scale employer, both in agriculture (indirectly) and in starch production (directly).

5. The use of starch in the EU - the market for starch.

In the EU, cca. 10 M tons of starch is used, whereof:

- 20% or 2 M tons is regular starch;
- 24% or 2.4 M tons is modified starch;
- 56% or 5.6 M tons is products for sweeteners.

The use of starch per inhabitant of the EU is cca. 20 kg/inhabitant, in the USA 85 kg/inhabitant.

The trend of starch use in the EU is continually growing, and it is estimated to increase by a min. of 5% by the year 2022!

It is important to note that in Slovenia, starch use as an ingredient is substantial in the paper industry (6 factories) and chemical industry (4 factories) and strong in the pharmaceutical industry (Krka, Lek-Novartis). Croatia is also an important market for starch, and it has no own production. Italy is also a large consumer of starch.

6. Modified starch and isoglucose

A minor amount of starch is used in its basic (native) form. Through physical, enzymatic or chemical processing, native starch is modified into various forms for use in different fields. This processing gives starch specific qualities that make it suitable for various uses. Modified starch also reaches a better price at the market. There are many different types of modified starch available on the market. Most of it is used in the food industry. A significant amount of starch is processed into different sweeteners that replace sugar.

Isoglucose (corn syrup) is a liquid sweetener that is produced from corn starch. It is principally used as a food sweetener, thus as an alternative to sugar. In 2017, the EU cancelled the sugar and isoglucose quotas. The quota for isoglucose was set at 700,000 tons. In view of the cca. 30% lower production cost of isoglucose in relation to sugar (dependent on the price of corn), it is estimated that the current 5% market share of isoglucose in the EU will rise to 25 - 30%. This will require 2.2 M tons of isoglucose. Therefore, the possibility of claiming a certain market share in the production of isoglucose also exists.

7. Gluten and sprout oil

In addition to starch as the basic product, a significant share of by-products in the form of proteins, fibre and sprouts result from production. In the EU, cca. 5 M tons of such by-products is produced.

Gluten is a by-product in the production of starch. It is an elastic and non-water-soluble protein with a broad application in the food industry. Cca. 6% of gluten flour results from the production of starch from corn.

The corn sprouts are separated in the production process and can be used to produce sprout oil. Corn sprouts can yield cca. 7% dry sprouts or 3% sprout oil, which is a very important food.

8. Basic raw material – corn

The ensuring of sufficient quantities of quality raw material (corn) with a large starch content at reasonable prices is the basis for economically successful starch production.

Corn is a very important industrial plant in Slovenia and its neighbouring countries Austria, Croatia and Hungary. Over 100 corn sorts exist worldwide. Over the years, sorts that are suitable for the production of starch and are suitable for specific geographic areas have been developed. Corn starch and its by-products can be very effectively further processed. The advantages of processing corn into starch lie in the ability to process the by-products that remain after the starch has been “taken from” the corn into animal feed, which sells well and can cover a significant share of the production costs of starch.

Many studies have shown the high economic significance of cultivating and processing corn. Corn claims an important (almost too large) share in crop rotation, thus it is important to take crop rotation into account when producing corn. Experts estimate that there are cca. 20% of growth reserves in revenues. Much higher revenues could be achieved, especially with irrigation.

Corn is composed of cca. 70% starch, 8% protein and 4% fat; the remaining ingredients are water, fibre and minerals. In starch production, special sorts of corn are utilised that contain higher amounts of starch (up to 70%). Practically every

component of the corn grain can be utilised; in processing corn into starch, we can efficiently utilise all the substances of corn.

The world production of corn totals cca. 1000 M tons. In the EU – 28, the production of corn for grains is estimated at 60 M tons.

Producing corn is relatively simple and “naturalised” in Slovenia and the neighbouring countries. Producers are competent and possess all necessary technological means for the cultivation and harvesting of corn. **The production of corn in grains in the year 2016 in Slovenia and its neighbouring countries totalled:**

- **In Slovenia cca. 350,000 tons;**
- **In Croatia cca. 1.8 M tons;**
- **In Austria cca. 2 M tons;**
- **In Hungary cca. 9 M tons.**

TSO Ormož is located 40 km from the Austrian and Hungarian border and is located at the border with Croatia.

According to our evaluations and the evaluations of the agricultural experts we interviewed, it would easily be possible to obtain 200,000 tons of corn within a 150 km radius of Ormož from Slovenia, Croatia, Hungary and Austria. The plant capacity could therefore be a min. of 200,000 tons of processed corn per year!

This is highly important in view of the costs of logistics (see **Figure 1**). Large quantities of corn from the above-mentioned areas and from Serbia are transported into Italy. This export runs through Slovenia in a manner that would allow for a portion of these quantities to be stopped and processed in Ormož.

9. The possibilities and advantages of the location in Ormož

The location of the former TSO d.d. in Ormož provides exceptional possibilities for establishing the production of starch or isoglucose. Such production is similar in process to the production of sugar and thus all the existing infrastructure is already designed in such a manner that it can be utilised in the production of starch or isoglucose.

The advantages of the location lie in its very good infrastructure and its designation as an industrial area intended for industrial construction. Among the important infrastructural elements, the following especially stand out:

- 220,000 m² land available for construction purposes;
- Electricity supply and distribution of 20 kV, 6MW;
- Supply of natural gas DN 200, kap= 20,000NM³, P= 4 bar;
- Modern telecommunication connections (internet);
- Three water sources - from the river Drava, from own wells (technological water) and from the municipal water supply (drinking water);
- Two access roads;
- Existing road and railway weighing scales;
- Active industrial rails with all necessary permits, throughout the entire location in the length of cca. 5 km;
- Existing production buildings in good condition, suitable for the instalment of production and storage capacities;
- A management building with offices, changing rooms, sanitation facilities and office spaces for 250 employees;
- A large quantity of areas suitable for construction for production or transport purposes;
- A location that is sufficiently distant from the town to avoid disturbances;
- Favourable purchase price that from the start provides for significant financial advantages in case of investment;
- Relatively speaking, many consumers of starch – buyers of the product nearby (within a 300 km radius).

10. The parameters of possible production

- **Processing capacity:** 200,000 tons of corn annually.
- **Why corn:** because the production of starch from corn is more competitive than that from wheat or potatoes and because sufficient quantities of corn are available on the market nearby.
- **Factory operating times:** 8000 hours/year (330 days continuously – 30 refitting).
- **Number of employees:** ~ 135
- **Products:**
 - Native corn starch ~ 130,000 t/year – in part modified starch, if desired.
 - Corn gluten ~ 12,000 t/year
 - Animal feed ~ 30,000 t/year
- **Investment value of the factory:** cca. 60,000,000.00 EUR.
- **Procurement of raw material (corn):** SLO, Croatia, Hungary, Austria (within a max. 150 km radius)
- **Sale of products (starch):** SLO, Croatia, Italy, Austria, Hungary, Slovakia.
- **Profitability: min. 18-25%.**
- **Location:** Ormož - the site of the former sugar factory Ormož, where all necessary infrastructure and energy products are already available (electricity, gas, water, roads, buildings, railway with a locomotive, etc.).
- **Duration of factory design and construction:** cca. 17 months.
- **Available necessary workforce:** (Many former TSO workers with experience in the food processing industry).

11. Production profitability estimate

The profitability of the concrete project could be precisely estimated based on a financial analysis and/or estimated income statement.

According to the evaluations of various studies, the main costs of corn starch production are the following, in percentages:

- Raw material (corn) ~ 65%;
- Costs of work ~ 14%;
- Energy costs ~ 12%;
- Amortisation costs ~ 6%;
- Maintenance costs ~ 3%.

Naturally, those are approximate values that vary from country to country and depend on other mutable parameters (energy prices, wages, etc.).

The costs of the raw material - corn certainly represent the largest share of production costs. This means that the profitability is connected with the fluctuations of raw material prices, which depend on supply, harvest (yield), weather influences, etc. Worldwide, corn yield per hectare is expected to increase with the development of new sorts that are suitable for certain climate changes and that contain more starch.

In any case, both world and EU experts foretell a prospective future for starch production. Since the sugar quotas in the EU were cancelled in 2017, an important share of sugar will certainly be replaced by isoglucose, the production of which is 35% cheaper than sugar.

According to data analyses and income statements of operating companies in the EU, the USA and the rest of the world, we can justifiably conclude that the profitability of corn starch production lies between 18 and 25%.