Starch: A pillar of society

Starch is one of the first and most versatile biopolymers used and was cultivated by mankind already in the very first settlements. While first being used for food almost exclusively, starch was one of the pillars of almost every society since thousands of years.

Although starch-containing crops are the major food source globally [1], it is also a key ingredient in technical industries such as in the fields of paper, textile, adhesive, and construction [2]. The by far youngest field of application of starches is the field of bioplastics.

Almost 11 million tonnes of starch and derivatives were produced in Europe in 2020, wheat and corn starch are having the highest share with 43 % each. The residual 14 % of the production are based on potato and pea. On the technical application side, the paper and corrugating industry uses around 32 % of the produced starch, while the food industry shows the highest demand, where about 54% of the starch is employed. [2]

In comparison to these well-established applications, the use of starch in bioplastics is almost negligible. Looking specifically at starch blends, the global production capacity was only 397,000 tonnes in 2021, and the global bioplastics production of all bioplastics on the market was 2.4 million tonnes [3].

However, while the bioplastic industry is still in its children´s shoes, it bears a tremendous potential to help to address many of the current utmost urgent topics, such as the reduction of the use of fossil feedstocks, establishing a circular economy, reduction of persistent litter, and even the improvement of compost quantity and quality. In this global context, the use of starch in bioplastic applications can make products more advantageous against the still predominant conventional plastic materials.

Types of Starch

Although starch is extensively used in its many varieties, there is often a lack of understanding of the nature of this very versatile biopolymer.

There is not only one "starch", but every starch source provides starches with a very specific property profile. Starch is a polymeric sugar that is used by plants as an energy reservoir. This polymeric sugar has two basic structural motifs: Amylose and Amylopectin. While Amylopectin forms the amorphous domains, the helical Amylose forms crystalline domains [4].

The ratio of the occurrence of these structural elements, the molecular weight of the starch and naturally occurring modifications are specific to the starch origin and lead to a variety of properties and, thus, fields of application.

In addition to the naturally occurring starch variants, it can also be further modified by chemical, enzymatic and physical means to influence for example the swelling behaviour, polarity, and water solubility [5].

With the deep know-how of production, processing, and modification of starch, AGRANA is serving all relevant industries and is not only a European but also a global player in the food and non-food starch using industry.

Thermoplastic starch & starch compounds

Based on that extensive industry experience Agrana developed the unique thermoplastic starch AMITROPLAST® and the starch-based compound AGENACOMP®. Both materials are certified *OK Compost Home* and make use of the locally produced, renewable, and GMO-free raw material *starch*.

Moreover, these materials are resource-efficient and avoid losses during the conversion from raw material to final product, which is usually observed by fermentative or chemical processes, when CO_2 or other by-products occur during the production process.

Starch can be introduced into most compostable polyesters, among which PBAT, PLA, PHBV, PBS, or mixtures thereof belong to the most widely used materials. Because of the highly polar nature and sensitivity of starch, the right compatibilizers and suitable processing conditions need to be found for a successful compounding with the polyester matrix, which often presents itself as challenging.

While many *thermoplastic starches* on the market are offered as starch compounds with a pre-determined matrix material, the granular Amitroplast-TPS contains already the necessary compatibilizers and provides the freedom of choice to compounders with respect to the specific mixture of biodegradable polyesters.

Agenacomp materials have originally been developed for blown film applications but have proven to be employable for other flexible applications as well. Agenacomp compounds provide a biobased content of up to 50 % which is fully based on Agrana's thermoplastic starch know-how.

The fully home compostable Agenacomp materials show similar properties to PE films in terms of oxygen and moisture barrier, as well as with respect to mechanical properties. Moreover, they are well processible in multi-layer setups to further adjust the properties of the final product.

The primary market for Agenacomp materials is flexible applications. Like the conventional plastics industry, flexible packaging holds the largest share of the material demand and capacities [3].

Examples of flexible packaging containing Agenacomp are products made by TIPA®.

Tipa manufacturers high-end compostable packaging for the food and fashion industries. The company is one of

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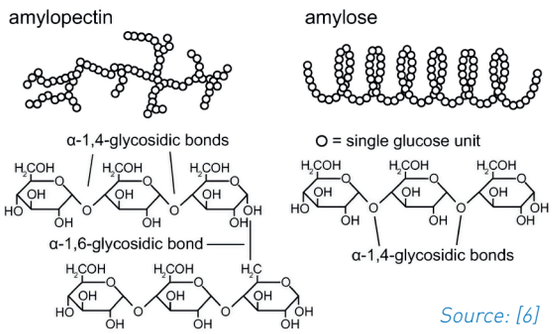
the world's leading experts in compostable packaging technology and offers new and innovative compostable solutions for flexible packaging. Tipa's expertise in converting compostable materials allows them to provide high performing, highly transparent, and fully compostable flexible film solutions for packaging applications.

Tipa and Agrana contribute towards a greener economy with compostable packaging in two ways: first, their compostable packaging serves to shelve and protect packed goods from damage and spoilage and second, these bags support the collection of biowaste for composting, where food waste is captured and biodegrades into nutrient-rich compost for soil regeneration.

www.agrana.com | www.tipa-corp.com



Source: [6]

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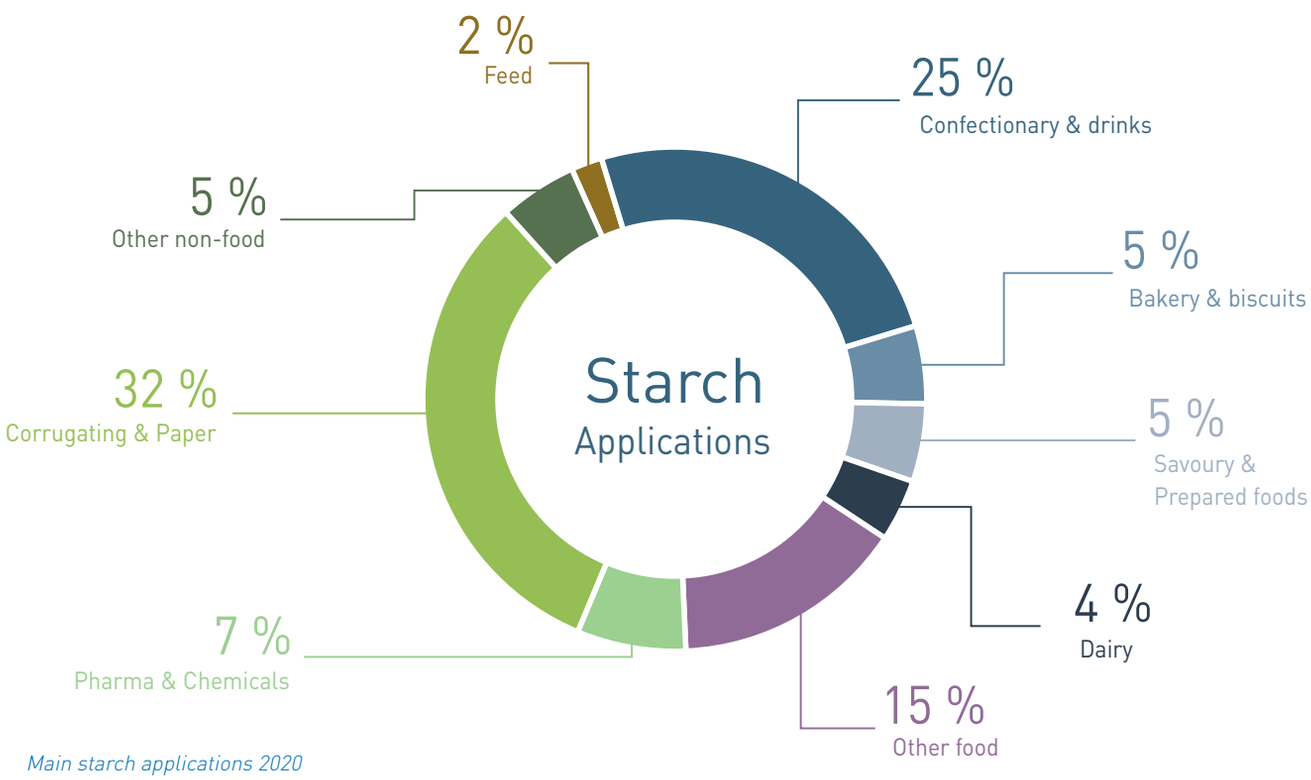

Main starch applications 2020