Unit –V

PASTA PRODUCTS

Macaroni and similar products

Introduction

Pasta is a generic term used in reference to the whole range of products commonly known as spaghetti, macaroni, vermicelli and noodles. Italy is generally regarded as the home of pasta products and it is the largest consumer of pasta products in the world. The Italians call these products *Pasta alimentare* (alimentary paste) since these products are made from alimentary dough of wheat semolina or flour and water. Pasta products are defined as a class of foods, each of which is prepared by drying formed units of dough made from semolina, durum flour, farina, flour, or any combination of two or more of these with water and with or without one or more of optional ingredients such as, egg white solids, quick cooking agents, seasonings, emulsifiers, milk solids, soya flour, vegetable solids, vitamins and minerals.

Pasta products in India are designated as Macaroni products. According to FSSA (Food Standards Safety Act), macaroni products means the product obtained from suji or maida with or without addition of ingredients like edible groundnut flour, tapioca flour, soya flour, milk powder, spices, vitamins and minerals. While as per BIS (Bureau of Indian Standards) other ingredients such as gluten, casein and vegetables are also permitted to be added in macaroni products.

Raw Materials for Pasta Products

Durum wheat

Durum wheat (*Triticum durum*) is the raw material of choice for the production of pasta products. Durum wheat is cultivated on about 8.8% of the total area of the world used for growing wheat, but it contributes only 4.5% of the world wheat production. Durum wheat is a tetraploid species and it is the hardest wheat amongst all the wheat. Durum millers generally prefer the following physico chemical characteristics during selection of wheat.

Semolina

Pasta products are manufactured principally from the three main milled products of durum wheat, namely semolina, durum granular and durum flour. Durum wheat is too hard to easily reduce to fine flour. First, durum wheat is cleaned to remove foreign matter, shrunken and

broken kernels. Then it is tempered (conditioned) to a moisture content of approximately 16.5% to toughen the seed coat so that efficient separation of bran and endosperm can take place. The tempered wheat is ground on a series of corrugated break rolls to open up and scrape the wheat kernels to release the endosperm from the bran. A second set of reduction rolls having finer corrugation is used to grind the middlings (semolina) to proper size. Various vibrating sieves are used between grinding steps to allow for efficient reduction of the endosperm to proper granular size. Final step of milling involves purifying to separate as much as of small bran particles and flour from the semolina. A commercial durum wheat mill will produce 64% semolina and 9% flour from good grade of durum wheat. Semolina with more uniform particle size is preferred as less problems are encountered in mixing the semolina and water to form a uniform dough for extrusion.

The optimum size for the semolina particles for pasta is about 150μ. Durum granular is used usually used in short-cut pasta such as shells or elbows. Durum flour is used primarily in the manufacture of noodles, as it yields smoother and more homogeneous dough.

Water

Water used in pasta products should be pure, have no off flavours and be potable. Since, pasta can be processed below pasteurization temperature, the bacterial count of the water is directly related to the bacterial count of the finished product.

Pasta Processing

All pasta products were home-made until about 1800 AD. Around 1850 AD the first hand-operated mechanical press came into existence. At the beginning of twentieth century, equipments like mixer, kneader, hydraulic extrusion press and drying cabinets became available. Pasta extrusion and drying has evolved to the mark where as high as 7000kg pasta can be continuously produced within an hour; with different size and shape.

The typical steps for pasta processing include continuous press, shaker/spreader, pre-dryer, finish dryer, storage and packaging.

Extrusion

In the continuous press, the semolina and water are metered in a predetermined ratio to form uniform dough. A dough moisture content of 30-31% yields excellent quality of pasta. Uniform mixing of water and semolina is carried out in a counterrotating mixing chamber. Counterrotating mixing shaft prevents balling of the dough. Some mixing chambers

operate under vacuum as it reduces formation of small air bubbles in the dough and limits oxidation of the xanthophyl/lutein pigments. Pigment oxidation otherwise reduces the attractive yellow appearance of the pasta and thus consumer acceptability. The presence of air bubbles in pasta reduces mechanical strength of pasta and gives chalky appearance to the pasta.

In the extrusion chamber, the hydrated semolina is passed through extrusion auger, which kneads the dough into homogeneous, cohesive plastic mass prior to extrusion through die. During extrusion, as heat generation due to friction is considerable, extrusion barrels are generally equipped with water-cooled jackets to maintain the pasta temperature near 40-45�C during extrusion process.

Pasta of various size and shapes can be made with change of dies and cutter knives. Generally bronze or stainless steel dies fitted with Teflon inserts are used. Teflon inserts extend the life of die and improve surface quality of the pasta.

Drying

Drying is most critical step in pasta processing. Pasta is dried from around 30-31% w/w moisture to 10-12% w/w moisture during drying process. Uniform drying of pasta is necessary to prevent moisture gradient. Uneven drying causes stresses, which can cause the product to crack or check (i.e. ruined by tiny hairline cracks). Checking can occur either during drying cycle or during storage.

Pasta drying is carried out in three or four discrete stages. The product is subjected to a blast of air for surface drying called ‘case-hardening’. The moisture in the pasta quickly reduced to 20-25% in about 1 hour in a pre-dryer at 65-66°C at 65% relative humidity (RH). At this moisture level, hard outer ‘skin’ is formed, which keeps the integrity of the pasta shape and flexibility. The pasta is equilibrated for 1.5 to 2 hours in the main dryer which is controlled at 55°C with RH at 95%. The temperature and RH maintained during the final stage of drying of pasta are 40°C and 70%, respectively. The moisture in pasta is reduced to 10-12% w/w at the end of drying. The dried pasta is allowed to cool to ambient temperature before being packed.

Drying is carried out in number of commercially available dryers. They can be divided into two classes. They employ either low or high temperature processes. In case of low temperature drying of pasta time required for drying of long goods is around 16 hours and for short goods it is approximately 8 hours. High temperature drying raised the drying temperature from 55°C to 75°C, which resulted in shorter drying times (10 hours for long goods, 4.5 hours for short goods), improved product and bacterial quality.

Recent pasta drying technology has increased drying temperature from 75°C to 100°C and above. These very high/ultra high temperature drying has many advantages like significant reduction in drying time (5.5 hours for long goods, 2.5 hours for short goods), improved bacterial and end-product quality and reduced investment and operating cost.

Microwave technology in conjunction with conventional hot air pre-dryers has been successfully employed for drying of pasta. Advantages associated with microwave drying are less floor space requirement (1/3rd to 1/4th of conventional dryer), reduced drying time (approximately 2 hours), improved product colour and cooking quality, reduced palte count, reduced sanitation and operation cost.

Packaging

There are many different sizes, shapes and types of packages in which pasta products are sold. The major considerations in choosing packaging material are: keeping the product free from contamination, sufficiently gentle mechanical handling to ensure minimal product breakage during shipment and storage, high degree of accuracy and precision in the weighing and filling of the packages and displaying the product favourably with consumer appeal.

Cellophane, low-density polythene bags and other types of flexible films are widely used for packaging of pasta products. Apart from this packaging, pasta is packaged into cardboard boxes, as they are easy to stack, provide good physical protection for the product and advertising is easier to print on boxes than on the plastic films. Modified-atmospheric-packaging (MAP) methods have also been used for packaging of fresh-pasta products, which are marketed in retail refrigerated cases.