

SMALL-SCALE TECHNOLOGIES AND MINIMALLY PROCESSED FOOD – AN OVERVIEW OF ACCESSIBLE TECHNICAL EQUIPMENT AND CONDITIONS OF IMPLEMENTATION ON THE EXAMPLE OF POLAND

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The aim of this work was to present the possibilities of the Polish industry to produce machinery for food processing. The offer of the Polish industry includes production not only for big processing plants, but also machinery and devices for food-processing on a small and medium scale. The offered machinery and devices allow for manufacturing refined products and also products included in the group referred to as “minimally processed products”. Many achievements in this field of processing technology and design of machines and devices do not differ from the European standards. Many-years experience and individual approach to customers result in the fact that machines produced in Poland meet in many cases the highest quality standards in the world. Polish machines for the food processing industry are exported to several dozens of countries, including the demanding markets of EU, USA and Canada.

INTRODUCTION

Small and medium enterprises are basic for the contemporary world economies. In Europe almost 99% of all the enterprises are micro-, small- and medium companies. In the European Union they employ approximately 65 mln of employees. In Poland there are over 3.5 mln registered small and medium enterprises (SMEs). They provide about 67% of work places and create about 48.6% of Gross National Product, and their operational area includes all of the branches of national economy.

In Poland SMEs play an important role in the agro-food industry, including manufacturing and distribution of machines and devices, processing of agricultural crops and services connected with the agro-food industry (design works, certification, attestation, laboratory tests, transport).

Polish industry has many-years' traditions in the field of manufacturing machinery and devices for the agro-food processing. The specific character and diversity of Polish agriculture have created great possibilities for development of processing industry and agricultural products. For many years the structure of agricultural production in Poland has included practically all branches belonging to the animal and plant production. Polish agriculture is characterised by a relatively big fragmentation. This causes some logistic problems and also generates supply for various kinds of devices and machinery for foodstuff processing.

The system transformations taking place in the 1990-ies have resulted in considerable property changes in the food

industry and forced a dynamic development of the existing and new production plants manufacturing machinery for the food industry [Kociszewski & Szwacka, 2007; Urban, 2006; Kłosiewicz-Górecka, 2004]. Free market has created new determinants and demands, mainly in the direction of adapting scientific and technological achievements to national needs. The demands of the market have indicated the direction of development also for small agro-food technologies including also processing directly taking place on the farm. Simultaneously the development of agro-tourism has caused further interest in food processing on a small scale.

Recently a bigger role in the agricultural products procession is played by SMEs (Small and Medium Enterprises). These enterprises are characterised by the following features: (i) they are individual property or belong to a small number of partners, (ii) they are managed by the owner or with his considerable involvement, (iii) they rely on the local demand or resources and the production is based on a very simple technology, (iv) they depend on their own capital mainly, and (v) they do not have a dominating position in the market [Commission Regulation, 2004].

According to the European Union Directives (2003/361/EC) SMEs include those enterprises which: employ not more than 250 employees, have an annual turnover in sales not exceeding 50 mln euro or assets not exceeding 43 mln euro [Commission Recommendation, 2003].

In a few years we expect that SMEs within agro-food processing will be dealing with: preliminary processing of ag-

ricultural crops; food preservation – especially important in countries suffering from a lack of food; producing components for multi-element food; producing minimally processed food; producing healthy food, high-quality food and regional food; producing commissioned food and with the brand name of big trading networks; and producing food with application of non-waste technologies.

The scope and manufacturing potential in individual countries depend on the accessibility of raw materials, energy (possibility of using unconventional sources of energy, including solar energy), water, local regulations with regard to ecology and production costs.

AN OVERVIEW OF ACCESSIBLE TECHNICAL EQUIPMENT AND CONDITIONS OF IMPLEMENTATION

The offer of the Polish industry includes production not only for big procession plants, but also machinery and devices for food-processing on a small and medium scale [Raczko, 2002]. The offered machinery and devices allow for manufacturing refined products and also products included in the group referred to as "minimally processed products". Many achievements in this field of processing technology and design of machines and devices do not differ from the European standards.

The machines and devices produced in Poland can be grouped into the following categories: (1) machines and devices for corn and bakery-confectioner's processing and production of food on the basis of corn products; (2) machines for fruit and vegetables processing; (3) machines and installations for fermentation industry; (4) machines and devices for oil plants processing; (5) machines and devices for processing of animal-origin products, including both meat, poultry, fish and milk; (6) machines for production of finished food products, gastronomic, trading and refrigerating; (7) machines for dosing, forming, packaging and bottling food products; (8) control-measurement apparatus; and (9) internal and external transportation vehicles. In each of the listed categories hundreds of machines and devices are produced with various sale of efficiency, facilitating compilation of many procession lines for production of semi-products and final products [Kiczuk, 1998].

Machines and devices for processing of corn and bakery-confectioner's products and food production basing on corn products include the following range of products: (1) for flour mills, including elements of pneumatic transport and initial processing and milling of corn; (2) for housing estate bakeries and village bakeries; (3) for confectioner's production, such as sugar-coated pills, caramel candies, milk pomades; (4) single- and double worm extruders; (5) extruding machines and forming machines for macaroni, catering products, driers for macaroni; (6) forming and separating devices including forming-separating kits, rollers for dough, rounding-off and elongating machines for dough; (7) chambers for growth of dough; (8) various-type mixers, confectioner's beaters; (9) chambers for drying macaroni; (10) devices for frying donuts; (11) machines for production and baking of salted crisps; (12) machines for forming confectioner's corpuses; and (13) baking ovens of various types, including: cyclo-thermal, cellular, rotational, and tube-cellular ovens [Raczko, 2002; Kiczuk, 1998].

A group of machines for fruit and vegetable processing includes: (1) machines for preliminary processing of the raw material including such devices as: various deices for washing, sorting and calibrating devices, cutters for bean pods endings, machines for stoning, wiping off and hulling; (2) devices for mincing and cutting: mincers, cutters, slicers, colloid mixers; (3) devices for heat processing, such as: open or vacuum steamers (with heating jacket), pots' (4) auxiliary devices, such as feeders, scales and containers of various capacity; (5) drying ovens; (6) devices for fluids filtering (filter presses for juice, wine, beer, oil); and (7) devices for preparing gas drinks [Raczko, 2002; Kiczuk, 1998]. The presented devices facilitate assembling a line for the production of: pulps and mousses, jams and candied fruit; fruit preserves, vegetable preserves, mushroom preserves, etc.; dried vegetables and mushrooms; potatoes processing into other products like chips, French fries; as well as sauces ("dressing"), ketchup, mustard and mayonnaise.

Machines and assembly lines for fermentation industry include: mini-breweries equipment ready for assembly in gastronomic outlets; breweries and fermentation tanks; and equipment of agro-distillery both for producing raw spirit and rectified spirit [Raczko, 2002].

Machines and devices for processing oil plants include: presses with conditioners for cool oil pressing, and devices for membrane oil filtering. These machines facilitate assembling a line for individual processing of oil plants for getting oil for comestible purposes and industrial purposes (for burning) [Kiczuk, 1998].

In Poland there are machines produced for processing of animal-origin raw materials, including meat, poultry, fish and milk. Here the following groups of machines are offered: (1) complete lines and elements for slaughter houses of hers and cattle; (2) equipping of meat procession units for production of smoked pork or meat division and partition (e.g. partition tables, meat presses, salty solutions stations, mixers); (3) machine elements for mincing-filling the coat; (4) steaming and smoking-steaming columns, steam-air ovens; (5) worm separators for separating meat from bones, bones grinding; (6) lines for obtaining animal fat; (7) equipment for poultry processing including such devices as: burners, drum pluckers, dismembering tables, machines for separating meat from bones, separators for obtaining meat from the corpses; (8) refrigerating or freezing doors; (9) devices for eggs processing (sorters, installations for condensing and drying of egg pulp); (10) equipment for milk-houses including such machines as: pressure homogenisers, tabular heat exchangers, centrifuges, rotor and piston pumps, containers and tanks made of acid-proof steel, filters, strainers and membrane modules; (11) production lines for pressed cheese and casein production from de-fatted milk and powdered whey; (12) devices for fish processing; (13) many devices for maintaining production hygiene (washers for washing containers and europalettes, basket washers); and (14) small-sized devices necessary for processing products of animal origin as well as many sanitary devices [Raczko, 2002; Kiczuk, 1998]. The presented devices together with manufactured in Poland equipment facilitate setting of complete lines for meat, fish and poultry processing and for small milk-houses.

Machines for producing ready-made food, food for catering, machines for trade and freezing include: (1) machines for producing pate, pancakes, and stuffed noodles; (2) machines for preliminary processing of raw material (washing devices, peeling devices for potatoes, carrots and beetroots), machines for mechanical processing (vegetable crumpling devices, cabbage shredding devices, food crumpling devices, vegetable mixers, stuff mixers, slicers for smoked meat, bread and cheese), multipurpose catering machines with many elements); (3) devices for heat processing of raw materials (convection-steam ovens, ovens for baking pizza, brewing pans, cookers, frying pans, electric chairs, devices for making chips, grilling devices, bakers, frying tables); (4) heating devices (heating cases, *etc.*); (5) refrigerating machines (to be exposed or kept in warehouses, technological); (6) technological furniture for preliminary processing and food preparation, furniture for preserving and storing food and for exposing ready products including glass-cases, counters, stands, tables, cases, containers, sinks, eaves; (7) electronic scales; (8) machines for internal transport of food products, plates, waiter carriages; (9) dishwashers, devices for sterilization of equipment and eggs by means of UV radiation; (10) sideboards and bar equipment; and (11) industrial systems [Raczko, 2002; Kiczuk, 1998].

A separate group is composed of manufactured in Poland machines for dosage, forming, packaging and distribution of food products including the following range of products: (1) packaging lines for carbonated and non-carbonated liquid products while pouring into glass and plastic jars and bottles (PET); (2) packaging lines for liquid and semi-liquid products while pouring into plastic packages and thermo-pressed bags; (3) filling devices and shutting devices for liquid and pasta-like products into metal packages and jars; (4) machines for forming and wrapping pasta-like products with films and parchment; (5) machines for thermal forming of film wrappings and dosage of semi-liquid products or separate wrappings closed with thermally welded film; (6) machines for forming film wrappings, tissue paper, paper, dosage of powder products and closing of packaging (automatic machines, semi-automated dosage machines, worm machines, capacity and weighing machines), packaging machines for plastic bags; (7) machines for wrapping packages formed into thermal-welded films (flow-pack), shrinking tunnels, devices enveloping with cellophane, foiling machine for cardboard boxes; (8) machines for forming bakery and confectioners' products (separators, rounding devices, forming devices for salted sticks, forming machined for culinary products, rolling devices); (9) machines for aseptic packaging (bag in box); (10) machines grouping and loading the separate packages into transport containers and cardboard boxes; (11) devices for wrapping of grouped products into thermo-contractile foils (contractile tunnels); (12) devices for preparing products for packaging (band mixers and drum mixers, granulators for agglomeration of powdery products); (13) labeling machines, date-makers, dosage machines, transporters and washers for bottles [Raczko, 2002; Kiczuk, 1998].

The devices for testing physical properties of raw materials, semi-products and products are as follows: kits for determining the quality and quantity of gluten; kits for evaluation of corn

quality in purchasing centers; and measuring devices for determining basic physical and chemical properties (pH-metres, thermometers, universal devices, electronic scales, *etc.*).

Means of internal and external transportation include: machines for mechanical loading and unloading; complete sets of overhead conveyors in meat factories; rolling and belt transporters, bucket conveyors, rolling conveyors, worm conveyors, belt conveyors, inspection conveyors, passing-weighing conveyors; and fork-lift trucks of various types [Raczko, 2002; Kiczuk, 1998].

CONCLUSIONS

Basing on the presented machines it is possible to set a series of technological lines facilitating production of many attractive products in small and medium enterprises. The following small technologies that are implemented and reliable in the Polish food industry are worth mentioning: automated lines for production of apple chips; lines for weighing, mixing and aromatizing of tea; lines for production of caramel pomade; lines for mixing and confectioning various kinds of consumable mixtures, such as herbs, spices, dried fruit, muesli, frozen stuff and salads; processing of fruit into jams, marmalades, plum jams, juice concentrates; production of candied goods of fruit, vegetables and herbs; processing fruit and vegetables into canned products (pickles, marinated cucumbers, compotes); processing vegetables and fruit into semi-products for gastronomy; production of dried vegetables, spices and herbs; production of fruit and vegetable sauces, including dressings, ketchups, fruit sauces for desserts; processing potatoes into chips, French fries; processing fruit into musts, morsels, cordials, *etc.*; production of fruit wines; production of carbonated and non-carbonated soft drinks; production of beer in mini-breweries; production of salted sticks; production of extruded crisps; production of crunchy bread with extrusion method; production of gastronomic products: pancakes, croquettes, noodles, pates, *etc.*; production of smoked sausages and similar products; fish processing; mini-bakery; farm milling machines; farm oil-extruders; production of various types of confectioners' products, including caramel candies; production of extruded food for domestic animals and fish; and various solutions for processing of side-products for animal fodder [Urban, 2003; Kiczuk, 1998].

The presented technological lines can be adapted to required efficiency, number of stands and individual solutions concerning setting of lines in processing enterprise. Polish companies also offer counseling in designing technological lines in existing and newly constructed enterprises. The solutions are mainly of individual character depending on the size and profile of the enterprise and customer's needs.

Many-years experience and individual approach to customers results in the fact that the machines produced in Poland meet in many cases the highest quality standards in the world. Polish machines are often equipped with modern automated and control systems imported from the leading manufacturers in the world. The machines offered by the Polish industry facilitate setting of complete technological lines; however when there is no a Polish machine or device, the imported ones are assembled. It makes complete utilization of

Polish industrial potential possible for the food industry production. The Polish industry has been co-operating for many years with leading manufacturers in Europe and since Poland joined the European Union, the scope of co-operation has been increased.

All of the offered machines, as long as there are such requirements, are made of high grade steel with application of mechanical and electronic subassemblies of the most renown companies and meet all the requirements connected with food processing.

National enterprises operate comprehensively by offering both counseling services and designing, execution, supply, assistance in launching the machines and training courses.

Well trained engineering-technical staff makes undertaking tasks for improving technical solutions possible by offering them to their customers at low price. Such effects are guaranteed by a highly qualified production workers, relatively low production costs in Poland and small organizational structure in most of Polish enterprises, which has no expanded and expensive managing body, which is a characteristic feature for small and medium enterprises.

It should be emphasized that Polish machines for the food processing industry are exported to several dozens of countries, including the demanding markets of EU, USA and Canada. The machines offered by Polish companies have both national and international certificates. The machines and devices have permits to be exported to EU Member States.

The existing on the Polish market companies often co-operate in order to adapt the functioning machines and devices to the customer demands, to create new solutions and build prototype machines as well as to carry on design-construction

works, starting from conception and finishing on developing construction documents of the object. In the case of complex design problems they establish cooperation with research-technology units. It is worth noting that many companies offer repair services and also specialize in tasks connected with manufacturing atypical machine parts or working units.

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MAŁE TECHNOLOGIE I ŻYWNOŚĆ MINIMALNIE PRZETWORZONA – PRZEGŁĄD DOSTĘPNEGO WYPOSAŻENIA I WARUNKI WDROŻENIA NA PRZYKŁADZIE POLSKI

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Celem pracy było przedstawienie możliwości produkcyjnych polskiego przemysłu produkującego maszyny na potrzeby przetwórstwa spożywczego. Oferta polskiego przemysłu obejmuje produkcję nie tylko dla dużych zakładów przetwórczych, ale także maszyny i urządzenia do przetwórstwa spożywczego w małej i średniej skali. Oferowane maszyny i urządzenia pozwalają na produkcję wyrafinowanych produktów a także wyrobów zaliczanych do grupy minimalnie przetworzonych. Wiele osiągnięć w zakresie technologii przetwarzania i konstrukcji maszyn i urządzeń nie odbiega od standardów europejskich. Wieloletnie doświadczenie i indywidualne podejście do klientów powoduje, że produkowane w Polsce urządzenia spełniają w wielu przypadkach najwyższe światowe standardy jakościowe. Polskie maszyny dla przetwórstwa spożywczego eksportowane są do kilkudziesięciu państw w tym na wymagające rynki Unii Europejskiej, Stanów Zjednoczonych i Kanady.