Valuation Note

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Parx Plastics

Listing on Euronext Access Paris

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Parx Plastics, the innovative biocide

Enterprise value: € 24.3 million

Parx Plastics, a new entrant in the markets

Founded in 2012, Parx Plastics is a Dutch company specialized in developing antimicrobial compounds for the plastics industry. The pioneering and innovative technology relies on the use of a trace element, zinc to make plastic polymers antibacterial.

A very simple innovation

Conscious of the increased importance of the public health questions and the consciences of the users, Parx Plastics has sought out and discovered a new way to treat plastic polymers to make them antibacterial. By using the trace element Zinc, this trace element is incorporated in 3% of a batch of polymers, which realizes an antibacterial and biocidal effect

A focus on growth markets

Parx Plastics initially focused on growth markets, food packaging and healthcare industries (medical equipment, prosthetics). These markets are characterized by their focus on the consumer. However, to achieve growth in Europe and Asia, Parx will have to rely on its distribution and production partners through multi-year revenue-generating contracts.

Parx is a real investment opportunity, considering its admission to the Euronext Access Paris market, the potential of its innovative solution and the strengthening of its distribution network. We are also confident in the management's ability to meet the challenge of the plant in China, including the establishment of a joint venture.

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Summary

Investment Thesis

Parx Plastics NV, a Dutch company founded in 2012 by Michael van der Jagt and Michele Fiori, to develop innovation in the production of specialty plastics, including antimicrobial plastics. The technologies of Parx Plastics respond to a current problem, which requires a drastic reduction of toxic and/or harmful elements in plastic. In this, the company meets the various European directives including REACH.

Parx Plastics capitalizes on 4 years of intensive research that has mobilized researchers in the fields of nanotechnology and biotechnology as well as microbiology and plastics to create a biomimetic technology. The result is that additives can be produced that, when mixed with polymers, lead to antibacterial plastics with an antimicrobial efficacy of 99%. Moreover, the produced plastics, which are biocompatible, have an excellent safety of use.

This technology is covered by several PCT patents, in March 2013 and has since been granted (Nov. 2016), offering more than twenty years of exclusivity to Parx Plastics in its operations in countries like the USA, Canada, China, Japan, South Korea, Brazil as well as Europe and the Pacific zone.

The product of Parx Plastics, with the trade name Saniconcentrate ™, is incorporated into the initial polymers prior to molding. The main characteristic of Saniconcentrate ™ is to integrate a zinc salt during the monomer polymerization process.

The strategy of Parx Plastics is to establish marketing agreements on specific areas with recognized partners. For example, the Dutch company has partnered semi-exclusively with Europe-based Nexeo Solutions, a Nasdaq-listed company, which distributes Saniconcentrate ™ across Europe. However, for China and Asia, Parx Plastics has made the choice to create a joint venture with the local government (which holds 40%), Ningbo Parx Plastics Tech Co, Ltd.

The market for plastics with antimicrobial properties is growing due to the demand in the Asia-Pacific zone. This increase is driven using plastics in various sectors of the economy from the disinfection of water to hospitals furnishing, pharmaceutical industry and chemical industry.

Introduction

Acute hygiene problems have increased in recent years. Several health crises have put forward these hygiene problems, largely due to population growth, and also the awareness of the importance of infections in terms of public health.

Bacteria, fungi and algae can become major public health problems in sectors as diverse as the medical sector, but also in construction, food and packaging.

Biocidal products are active substances that can destroy, inactivate, render harmless, prevent the action or exert a control effect on any harmful organism by chemical or biological means. Biocidal products include: disinfectants, certain chemicals used as preservatives of materials and/or products, non-agricultural pesticides and anti-vegetative products.

Antimicrobials are used to control the accumulation and growth of bacteria in surfaces, such as plastics and other materials. In view of this growing need to reduce the presence of bacteria, the market for antimicrobial additives has gradually developed, mainly towards the food industry. The use of biocides in plastics has become common not only because of its preventive action against microorganisms by providing a surface free of microbes, but also because of its physical and "aesthetic" characteristics by preventing degradation of plastics (black spots or discoloration).

The most demanding sectors are food processing plants, hospitals and nursing homes offering an ideal environment for microbes. The incorporation of biocides into plastics and rubbers, can help to reduce cleaning time. The biocides most used to fight against these microorganisms have two main roles:

- To prevent bacteria or fungi from degrading the physical and sensory properties of the polymer, reduce microbial populations both in the material and at the surface. The growth of microorganisms can lead to unpleasant odors, superficial degradations. Reducing odors is a goal for applications such as clothing, shoes, garbage containers, etc.
- To avoid the accumulation of harmful bacteria increasing the risk of contamination and transmission of infections in humans. A biocide acts as a complementary technique to cleaning, which is also simplified and less expensive

Biocides are chosen based on their function and application, but the choice of the right biocide is often not so simple. In addition to biocidal performance, stability, migration, leaching ability, stability under light and heat can be important factors.

Bacteria and Biofilms

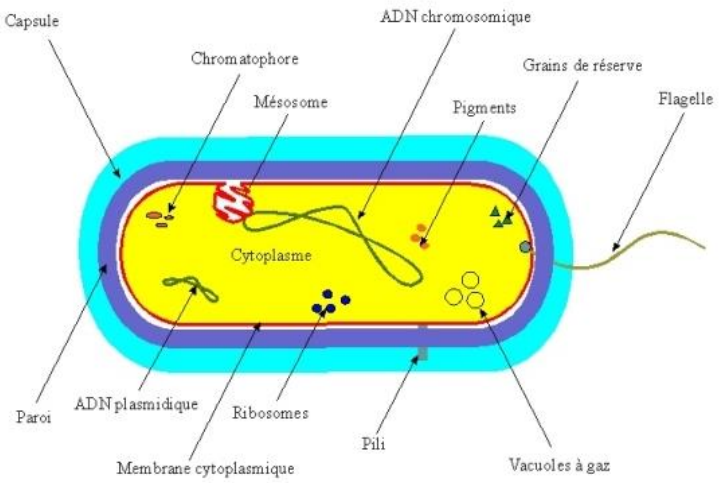
Bacteria

The bacteria are prokaryotic unicellular microorganisms, and have a size in the order of micrometer (µm), between 200 nm (nanobacteria) and 1 mm (giant bacteria); three types of bacteria can be identified:

- Spherical which characterizes the Cocci or cockles, which often gathers in the form of chain (streptococci) in grape bunch (staphylococci);
- Cylindrical / rod-shaped is characteristic of bacilli, which can sometimes be curved like vibrios or club-shaped (see corynebacteria)
- In spiral, this form is the preserve of treponemes, leptospires or spirochetes.

However, there are common and constant elements that cross all the bacterial species such as the bacterial wall, the cytoplasmic membrane and the cytoplasm as well as optional elements found in certain species such as plasmids, capsule, flagella.

ANATOMY OF A BACTERIUM

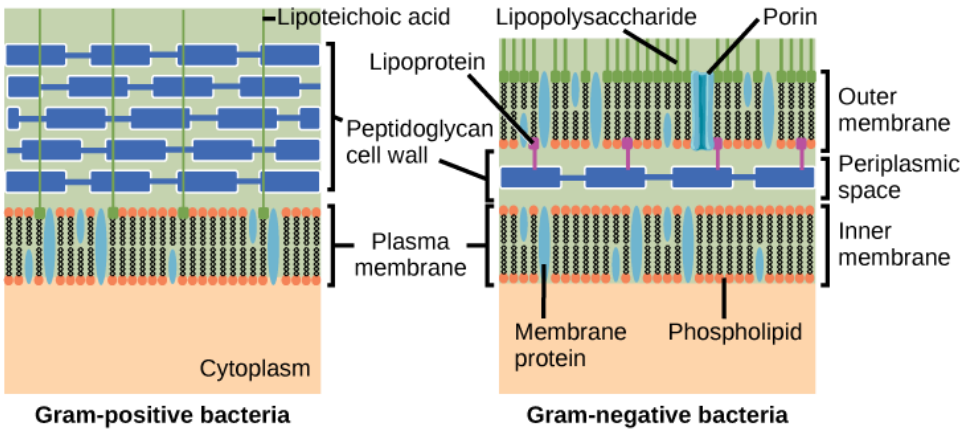


Source: http://www.ecosociosystemes.fr/cellule_bacterienne.html

The bacterial wall is an essential element of the bacterium because it encloses all the structures that make up the bacteria. It is also responsible for the shape of the bacteria and protecting it against external aggression (pressure, temperature, drought, etc...). It plays in a way the role of an exoskeleton. This wall is composed of a biopolymer: the peptidoglycan, also called mucopeptide, murein or complex mucopeptides. Although composed of the same elementary unit, the structure of this wall will differ in its organization thus making it possible to differentiate the bacteria.

Its structure is different depending on the group of bacteria Gram (+) or Gram (-). The Gram straining technique makes it possible to differentiate them. It gives a purple color to gram-positive bacteria (+) and a pink color to Gram-negative bacteria (-). The other method of differentiation that appeared later was electronic microscopy. It makes it possible to identify more precisely the elements present on the bacterial wall.

COMPARISON BETWEEN A GRAM (-) BACTERIA AND A GRAM (+) BACTERIUM



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The difference in susceptibility of one bacterium to the other against antibacterial agents is conditioned by the difference in chemical nature between Gram (+) and (-) bacteria, sometimes within the same species. In general, the survival of a bacterium depends on the proper functioning of these organs. Thus, biocides can act by altering and inhibiting cell wall synthesis, altering the permeability of the cytoplasmic membrane, and inhibiting protein synthesis and enzymatic activity of the cell.

biofilms

There is fossil evidence dating back 3.4 billion years that microorganisms existed as micro-colonies attached to surfaces [1], establishing the biofilm as one of the oldest forms of life on Earth. Although the scientific study of microorganisms on surfaces dates to the 17th century, it is only in the last decades that their relevance has been appreciated in natural and pathogenic ecosystems. [2]. Although the term "biofilm" has been used since the 1930s to describe surface-adherent microbial adherent communities in industrial and environmental applications, it was not until 1985 that Bill Costerton introduced this term into the medical microbiology.

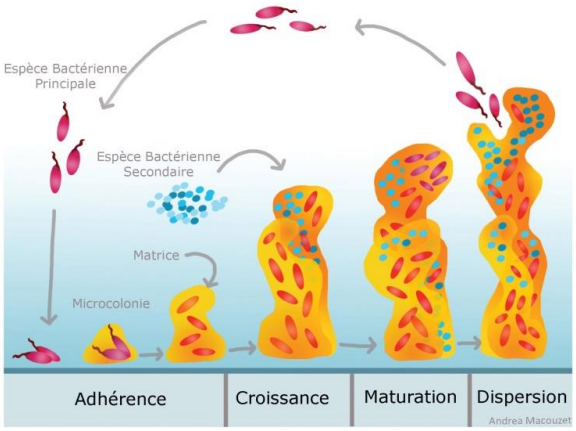
The refractory nature of many infections has been largely attributed in recent decades to the continued increase in antibiotic resistance, but the involvement of biofilm in microbial tolerance to antimicrobial agents and immune cells is increasingly recognized. The combined effect of biofilm tolerance and antibiotic resistance are the two most important microbial defense strategies and, in combination, pose a significant risk to public health. In 1999, Costerton et al. [3] reported that bacterial biofilm was a common cause of persistent infections that included conditions such as periodontal disease, otitis media, cystic fibrosis, pneumonia, and device-related infections.

Thus bacteria, and more generally, the microbes can be structured clusters consisting of a set of microorganisms (living and dead) coated with a polymeric matrix and adhering to a surface that may be of biological origin (mucous membrane) or abiotic (floor, dashboard, keyboard, medical equipment). The formation of a biofilm is done in several stages according to a well-established model.

The ability to form a biofilm is now recognized as a characteristic of many microorganisms. It is

estimated that 80% of the microbial biomass of our planet resides in the form of a biofilm [4]. As can be seen in the diagram below, biofilm formation takes place in several stages. Firstly, the adhesion of bacteria or microorganisms on the support that can, as we said, biotic or abiotic. This adsorption is carried out thanks to the presence on the bacterial surface of structures. Other bacteria will clump together forming a " first micro-colony".

FORMATION OF THE BIOFILM



Source: http://www.cresa.cat/blogs/sociedad/en/espanol-biofilms-bacterianos-por-que-deberia-importarnos/

Then these bacteria will synthesize an extracellular polymeric matrix composed of exopolysaccharides as well as other constituents. In its process of growth and maturation, other bacterial species can associate with the initial matrix. The ultimate stage of biofilm formation is often the detachment and dispersion of bacteria. These cells could adhere to new surfaces and reform a biofilm [5]. Detachment and dispersion of bacterial cells in a biofilm are important in the transmission of bacteria from environmental reservoirs to a host (animal or human), in the transmission between the host and the spread of infection in a host [6].

Thus, microbial colonization in the form of biofilm is often at the root of serious industrial and societal problems and in very diverse fields. In the agri-food and pharmaceutical industry, the formation of a biofilm can lead to reduced yields and increased costs. Thus, in orthopedic surgery, where implant-related infections remain among the main reasons for failure, the most critical pathogenic event in the development of implant-related infection is biofilm formation. It is initiated immediately after bacterial adhesion to the implant and effectively protects microorganisms against the immune system and systemic antibiotics. One of the avenues for preventing these biomaterial-associated infections should then specifically focus on inhibiting bacterial adhesion and biofilm formation.

Biocide, antimicrobial, antifungal, pest control ...

Biocidal products are today an integral part of our daily lives. It is necessary to distinguish the products antibiotics, pesticides, household and hospital disinfectants, anti-mold paint, water purification tablets.

Four groups of biocidal products

- **Group 1 - Disinfectants:** human hygiene, disinfectants and algicidal products not intended for direct application to humans or animals, veterinary hygiene, surfaces in contact with food and feed, drinking water.
- **Group 2 - Protective products:** protection of products during storage, protection products for film, wood preservatives, fiber protection products, leather, rubber and polymerized materials, construction materials protection products, liquid protection products used in cooling and manufacturing systems, anti-biofilm products, protection products for working or cutting fluids.
- **Group 3 - Pest control products:** rodenticides, avicides, molluscicides, vermicides, products used to control other invertebrates, piscicides, insecticides, acaricides, products used to control other arthropods, repellents and baits, control against other vertebrates.
- **Group 4 - Other biocidal products:** Antifouling products, fluids used for embalming and taxidermy.

To determine whether there is a real biocidal product, the first criterion is the claimed use of the product, even if the actual purpose is to be considered, as indicated by the Ministry of Ecology. Bacteria can be killed or inhibited in their growth by different antimicrobial products, namely antibiotics that act against infections in humans or animals, and biocides such as disinfectants and preservatives.

By nature, some bacteria are insensitive to antimicrobial products, while others may develop resistance to certain biocides over time. Bacteria can become more and more tolerant to antimicrobial substances so that they can withstand progressively higher concentrations. In some cases, resistance to biocides can lead to antibiotic resistance. Strains of resistant bacteria can survive concentrations of biocides that would kill most bacteria of the same species. Biocides must be approved before being placed on the market. However, unlike antibiotics whose use in humans and animals is carefully controlled, biocides can be used without any form of control.

On September 1st, 2013, a new regulation on biocides became effective, where all items treated with biocidal products are covered by the legislation. Because of this widening of the scope of legislation: "*Imported goods treated with biocidal products should have been by an active substance approved in the European Union*", explains the Bureau of Chemical Substances and Preparations of the Ministry of Ecology. This considerably broadens the scope of companies affected by this legislation.

The regulation

The regulatory component and government regulations have a major impact on the use of antimicrobial biocides in the plastics industry. For example, in most of developed countries, the chemical components of a biocide must be listed in a national " inventory " or registered before they can be used. In addition, all uses in applications requiring contact with the public such as medical devices or food contact should be subject to additional legislation that often requires additional product registration. In the US, for example, biocides are listed in the National Inventory of Chemical Substances called TSCA (The Toxic Substances Control Act Chemical Substance Inventory). In addition to listing on the TSCA, which is a national act, there are regulations governing the use of biocides both at the federal level with the Environmental Protection Agency

(EPA) and at the state level. For the rest of the world, countries have their own regulations governing the use of biocides or rely on biocides from the EPA regulations.

In Europe

Since September 1st, 2013, a new regulation, the EU Biocidal Product Regulation N ° 528/2012 or BPR (Biocidal Product Regulation) has replaced the old Biocidal Product Directive (BPD). The purpose of the BPR is to establish a list of authorized biocides (active substances) within the European Union, i.e. Annex I of the BPR. Companies wishing to register a compound with antimicrobial activity or a biocide must therefore submit a dossier, which is then evaluated by the European Chemicals Agency (ECHA). Based on an opinion prepared by ECHA, the European Commission will decide that the active substances will then be approved, excluded or proposed for substitution with another active ingredient. However, the approval of an active substance does not cover its "nanoform". Nanoscopic formulations must therefore be evaluated specifically and separately from the bulk material. Biocides containing approved active substances require authorization during a second phase of the regulatory process. Biocidal products are grouped into 22 types of products (PTs), which are divided into four main groups (PT 1-5 disinfectants, PT 6-13 preservatives, PT 14-20 pest control and another biocidal products PT 21-22). The treated articles that contains or contain biocidal products or active substances will require labeling under certain conditions (e.g. when a claim for biocidal properties is made on the product or when the labeling of a specific active substance is legally required).

In the U.S.

In the United States, antimicrobial substances used in or on any Food Contact Material (FCM) that may cause residues in or on food are classified as food additives or pesticides [7]. Both terms are defined in § 321 (q) and (s) of the Federal Law on Food, Drugs and Cosmetics (FFDCA, 21 USC, Chapter 9). Depending on their application, these substances are regulated by two different authorities: FDA with FFDCA for food additives and EPA with FFDCA for chemical pesticides. Antimicrobials used in or on food packaging, preservatives of materials, and non-functional antimicrobial components in food contact articles are regulated as food additives by the United States Food and Drug Administration (FDA) under FFDCA, paragraph 348. The United States Environmental Protection Agency (EPA) under the FFDCA, paragraph 346a, regulates substances in contact with food with an antimicrobial effect on permanent or semi-permanent food contact surfaces. A complete list of food additives extracted from different parts of 21 CFR can be found on the FDA homepage. Regulatory and data requirements for pesticides, including antimicrobials, are regulated by 40 CFR Part 158. Maximum residue levels and exemptions for pesticide chemicals in foods are listed in 40 CFR Part 180.

The need for biocides in plastics

For the last ten years, the plastic industry has been engaged in a major hunt for microbes and more specifically for bacteria. The goal is to manufacture and invent new plastics capable of acting as a barrier against microorganisms. Moreover, the new applications seem promising, whether in the field of health as in that of food. The question is to find what antiseptic can be incorporated into the polymer constituting the basic material of plastic. Initially, the idea may seem simple, but what would be this miracle product likely to ensure a hygienic barrier and lasting stability

depending on the different environmental conditions: temperature, humidity, light?

During the last decade, several food crises have insistently emphasized the need for antimicrobial products to reduce the risks associated with contamination, especially that of food by pathogenic species. In the United States, nearly 128,000 people are hospitalized and 3,000 die every year [8]. In 2010, in the UK, Campylobacter-infected poultry has generated more than 300 000 poisonings and some 15 000 hospitalizations [9]. In Canada, food contamination accounts for more than 11 million cases of poisoning each year [10]. In 2008, during a Listeria outbreak, 57 people were infected, resulting in 22 deaths. Several strategies have been considered to reduce the bacterial presence, especially in food packaging:

- The development of films having a detection function;
- The increase of barrier properties;
- The incorporation of a bactericidal effect.

If the use of films with a detection function, a particularly innovative technology, is interesting in terms of security, to prevent the consumption of expired food, seems however incompatible with the large distribution needed today, due to the cost. On the other hand, the other two strategies have the advantage of increasing the shelf life of foods. The increase in the properties of food film barriers is preventing, for example, the transfer of gases (oxygen...). Especially since the incorporation of a bactericidal effect in detector films or barrier films would be perfectly complementary to them. Various methods have been developed for incorporating molecules with a bactericidal function, among them are:

- Coatings;
- The mixture in solution;
- Melt mixture.

Among these methods, the mixture in the molten state was chosen for its advantages, such as the ease of formatting and the costs involved for its implementation on an industrial scale.

Different technologies have been developed recently to sterilize the surface of certain objects around us. By making the surface hydrophobic [11], or by adding a chemical additive specifically designed to possess antibacterial properties [12]. This type of application is very popular, particularly in the field of textiles [13]. However, in an industrial context, it is important to consider the costs associated with the implementation in the production. Adding this to a production stage would impose a substantial additional financial burden. Thus, the addition of an additive as it is an already existing process step is an interesting approach. In addition, in a context of food safety, it is essential to consider the dangers that can arise from the contact of chemical substances with food. Thus, the addition of antibacterial additives should be approached with caution.

There are at least two classes of antibacterial agents, organic and non-organic. Organic agents include chemicals from organic chemistry as well as essential oils. While the inorganic or non-organic antibacterial agents consist mainly of metals and ceramics. Nano scale metal oxide particles, which are specifically selected for their high bactericidal capacity, thermal stability, and mechanism of action, have recently emerged. These are commercially available at relatively affordable prices, but very often exhibit diffusion phenomena.

Over the last decade, several studies have investigated the ability of surface modifications to minimize bacterial adhesion, inhibit biofilm formation, and kill bacteria. We can distinguish the following methods:

1. Passive surface finishing / modification (PSM): passive coatings that do not release bactericidal agents into surrounding tissues, but that aim to prevent or reduce bacterial adhesion through chemical and / or structural modifications;
2. Active Surface Finishing / Modification (MSA): active coatings that contain pharmacologically active pre-incorporated bactericidal agents;
3. Carriers or local coatings (LCC): local or non-biodegradable antibacterial carriers or coatings, applied at the time of the surgical procedure, immediately before or at the same time as and around the implant.

The classification of different technologies can be useful for better comparing different solutions, improving the design of validation tests and, hopefully, improving and speeding up the regulatory process in this rapidly evolving field.

Methods and technologies

There are different solutions to give plastics antimicrobial properties. They are largely organic such as BIT (Benzisothiazoline-one), DCOIT (Dichloro-octyl-4-isothiazolin-one), IPBC (iodopropynyl butylcarbamate), TBT (tributyltin), TBZ (Thiazolyl benzimidazole). For many years, the plastics industry has relied on OBPA or 10,10-oxybisphenoxarsine, which has a relatively broad spectrum capable of being effective against Gram (-) and (+) bacteria as well as fungus. OBPA, is mainly produced in Asia, formulated at a concentration of 2% and 5% and whose turnover is now around 19 million dollars. Another compound, DCOIT for 4,5-Dichloro-2- (n-octyl) -4-isothiazolinone-3-one, is replacing OBPA more and more, and has a turnover of more than 25 million dollars. DCOIT has a better biocidal activity with a water solubility lower than the OIT (Octyl isothiazolinone). Another biocidal product that has been widely used is Triclosan, but in recent years it has been banned from many products both in Europe and the USA. Animal tests have shown that exposure to high doses of Triclosan can induce a drastic reduction of certain thyroid hormones. Other studies have shown that bacterial exposure to Triclosan can lead to bacterial resistance phenomena. Both the FDA and ECHA are conducting studies on the safety of Triclosan and studies evaluating the benefit-risk ratio of this molecule. Recently, the plastics industry has turned to inorganic compounds such as copper or silver. Silver known for many years as a powerful bactericide, made a comeback in the plastics industry. Today, silver derivatives represent a turnover of 77 million dollars; making it the most widely used biocidal derivative in medical devices because of its resistance to high temperatures, care cost (0.2 to 0.5 dollars / kg of treated product). Silver is formulated in different ways to be integrated in masterbatches (plastic resins) from zeolites to nanoforms, by increasing the contact surface of bacteria with silver ions makes the product very effective. However, many consumer associations are alarmed at the potential harmfulness of silver and its nanoparticulate formulations. This offers opportunities for Parx Plastics, which with a compound already present in trace amounts in the human body, can offer a real alternative in the field of inorganic compounds with antimicrobial properties.

DETERMINATION OF THE MINIMUM INHIBITORY CONCENTRATION

Supplier	% of active ingredients	Use rate
Troy	OBPA 2%	1 - 2 %
Siranen	Argent 1%	1%
DOW	DCOIT 5%	2 - 3 %
Lonza	Zinc Pyrithione 99%	0,2 - 0,5 %
Troy	IPBC 99%	0,1 - 0,2 %
DOW	OIT 100%	0,1 - 0,2 %
Parx Plastics	**Zinc Element Trace**	**3%**

Source: Biocide Information; Report Biocides in Plastics 2017, Parx plastics.

Usage rates vary greatly depending on the products and their effectiveness. Thus OBPA, which is certainly one of the most toxic biocides currently on the market, requires 400 ppm (parts per million) of active ingredient in the final product. The amount needed for other less active molecules can go up to 2000 ppm for the same level of efficiency. Today, silver and all its variations are the most "popular" antimicrobial, because of its level of efficiency, it adds only $ 0,2/kg to the cost of the final product.

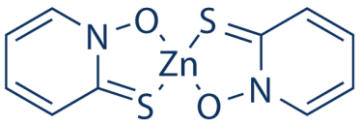
Parx Plastics technology

Parx Plastics' approach has allowed developing an antibacterial product that is environmentally friendly and non-toxic, cost-effective and has a real competitive advantage by improving the antimicrobial behavior of the original product. Many studies show the importance of transition metals such as copper and zinc in controlling bacterial growth. For this, Parx Plastics turned to zinc as a trace element by creating the product Saniconcentrate™.

Parx Plastics technology can also be used in applications that were previously not possible to incorporate effective antibacterial property due to safety concerns. An antibacterial property on the products offers extra hygiene, safety, protection and peace of mind. Some examples to illustrate which items can benefit from an antibacterial property: a toilet seat, a switch next to the bed in a hotel room, a remote control, medical equipment cases, a doctor's smartphone, a basket handle, dialysis lines, respiratory tubes, agricultural leaves, food packaging, nonwoven medical aprons, etc.

Zinc: an antimicrobial?

Zinc (Zn symbol in the periodic table of elements) is an essential antioxidant trace element for all living organisms. It is involved in several metabolic pathways such as the metabolism of proteins and fats, as well as in the production of prostaglandins and the stabilization of certain hormones such as insulin, or thymuline. When combined with superoxide dismutase, it has an antioxidant action especially on oxidative stress [14]. The Age-Related Eye Disease Study (AREDS) found that zinc supplementation would have reduced the number of deaths attributable to cardiovascular disorders [15].



In addition, many scientific works have shown its antibacterial properties. It has been incorporated into textiles, surfaces, pigments, paints, cosmetics and polymers such as polypropylene, polyethylene terephthalate (PET). Most of these uses were made in the form of zinc oxide nanoparticles (ZnO- Np) or in combination with silver ions in the form of an epoxy-associated zeolite powder for coating solid surfaces to inhibit microbial growth [16]. Zinc pyrithione (see the chemical formula above), which is a proton pump inhibitor, is considered an antifungal and antibacterial agent.

Immune system cells use zinc at low doses to eliminate certain bacteria such as tuberculosis bacteria or E. Coli by intoxicating them [17]. These results show a role for zinc and could serve as a basis for new treatments ranging from zinc supplementation for certain infections to the development of new antibiotics. The intimate mechanism of this action of zinc remains to be demonstrated. But the first leads indicate that zinc and the other transition metals present in the macrophages (immune cells responsible for the destruction of microorganisms) act by blocking the zinc pumps put in place by the bacteria to eliminate it.

The body needs very little zinc, but this is essential. Zinc deficiency is common. Oysters contain the most zinc, followed by meats and nuts. Seeds (e.g. of sesame and pumpkin) as well as vegetables and whole grains also contain them.

Zinc pyrithione is an over-the-counter organic zinc compound for dandruff and seborrheic dermatitis. Zinc compounds are antifungal and bacteriostatic.

The antimicrobial properties of ZnO-NP are attributed to oxidative stress and abrasion [18]. The oxidizing effect results at least in part from the uptake of photons from UV light, the rearrangement of electrons and the generation of reactive oxygen species. But at least some antimicrobial effects are retained in the absence of light. There is evidence that hydrogen peroxide is generated as an oxidant [19].

Most studies show antimicrobial activity against Gram (-) and Gram (+) bacteria, although it varies with the preparation of the nanoparticles and the details of the manufacturing processes of the final product [20]. Zinc is also known for its antiseptic activity. Studies have been carried out on cultures of microorganisms such as E. Coli, S. Aureus or C. Albican. It turns out that zinc can inhibit bacterial and fungistatic proliferation [21].

DETERMINATION OF THE MINIMUM INHIBITORY CONCENTRATION

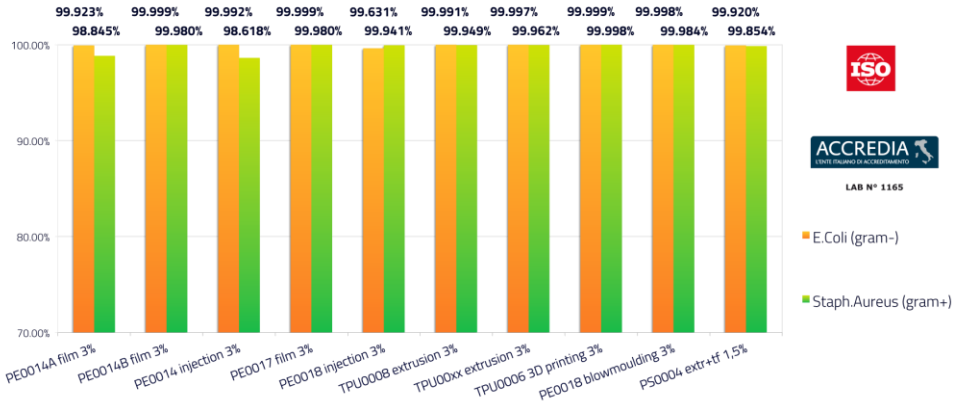
Activity	Methods and duration	Products tested & dose	Results
Inhibitory activity against microorganisms	Contacting the product with a titrated concentrated nutrient broth following concentrations of zinc sulphate are tested: 0.25, 0.5, 0.75, 1 and 1.5% vis-à-vis S. aureus and E. coli 0.75, 1, 1.5, 2 and 2.5% with respect to C. albicans After incubation 24h at 32 ° C, microbial growth is appreciated. A count is done. The minimum inhibitory concentration is evaluated and corresponds to the first concentration allowing the initial inoculum to be found.	0.25, 0.5, 0.75, 1, 1.5, 2 and 2.5% zinc sulfate or gluconate	Minimum inhibitory concentrations were evaluated: ➢ less than 0.25% zinc sulphate, i.e. 0.4% zinc gluconate for S. aureus and E. coli ➢ less than 0.75% of zinc sulphate, i.e. 1.2

Source: https://www.etatpur.com/media/synthese_biblio/Fiche-Zinc-Gluconate.pdf

Sanipolymers and Saniconcentrate

Mixing Saniconcentrate™, with untreated polymers create Sanipolymers™. The effectiveness of Sanipolymers™ measured by the ISO 22196 method is 99%. This method allows measurement of antibacterial activity on plastic surfaces and other non-porous surfaces. It has been designed to quantitatively test the ability of plastics to inhibit the growth of microorganisms (bacteriostatic) or kill them (bactericides) over a 24-hour contact period. It is a relatively sensitive test, which means it can detect low-level antimicrobial effects over long periods of time. The second edition of the method extends its applicability to other non-porous surfaces, no longer limiting only to plastic surfaces.

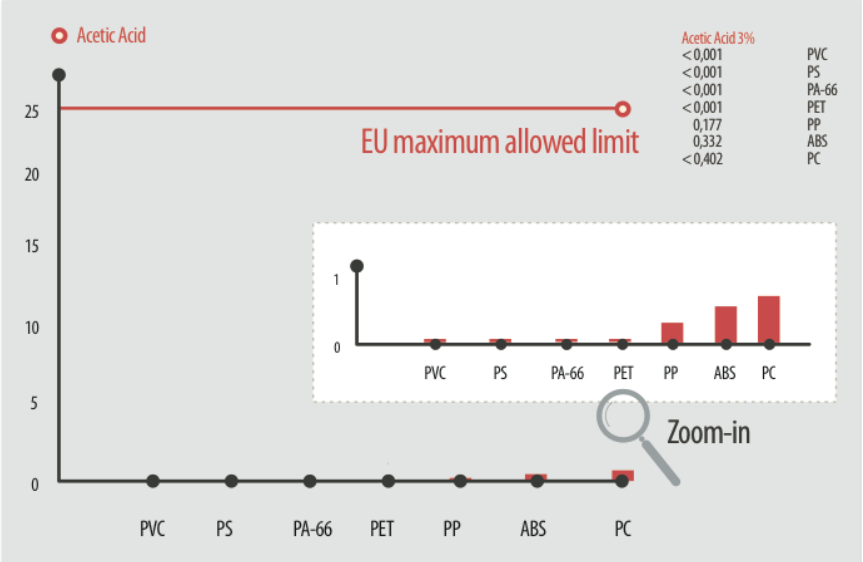
RESULTS OF THE ISO 22196 TEST WITH SANIPOLYMERS ™



Source: Parx Plastics.

In the ISO 22196 test the microorganism is prepared, usually by growth in a liquid culture medium. According to the method, two representative microorganisms are specified, *Staphylococcus aureus* and *Escherichia coli*. The suspension of the test microorganism is normalized by dilution in a nutrient broth (this allows the microorganisms to grow during the test). The control and test surfaces are inoculated with microorganisms, in triplicate, and then the microbial inoculum is covered with a thin sterile film, which allows the inoculum to be spread out while reducing evaporation and ensuring close contact with the antimicrobial surface. Microbial concentrations are determined at " time zero" by elution followed by dilution. A check is made to verify that the neutralization / elution method effectively neutralizes the antimicrobial agent in the antimicrobial surface tested. After incubation, the microbial concentrations are determined. The reduction of microorganisms in relation to the initial concentrations and the control surface is calculated. By including the appropriate controls and being able to make these reduction calculations, this test allows us to interpret whether the test substance is bacteriostatic, with the ability to inhibit the growth of microorganisms, or if the test substance is bactericidal.

DETERMINATION OF THE MINIMUM INHIBITORY CONCENTRATION



Source: Parx Plastics.

Parx Plastics has conducted several tests to determine the stability and "toxicity" of Saniconcentrate™ within the Sanipolymer ™, as although zinc is not toxic *per se*. To be consistent with the regulations of the European Commission No. 10/2011, Parx has realized several zinc migration tests out of the polymer matrix. According to regulations, this leakage must not exceed 25 mg/kg of food. Various tests are carried out in different "food simulants" from 10% ethanol, 3% acetic acid, or oil which show that the zinc does not diffuse, or zinc diffusing proportion is much lower than the standards in force (in a ratio from 1 to 25, 40x lower).

Parx Plastics, an innovation company

Company Profile

Parx Plastics is a Dutch chemical additives company focused on the development of antimicrobial chemical solutions for plastics. Created in 2012, by Michael van der Jagt and Michele Fiori, with the aim of producing antibacterial and antimicrobial chemical additives that are respectful to the environment. The products developed, which are mainly chemical additives, can therefore be deployed in various sectors of the economy. Parx Plastics additives work with plastics without compromising the plastic integrity. Parx Plastics has established strategic partnerships to quickly establish its market access.

History of the company

A few years ago, the founders found that demand for plastics with antibacterial and antimicrobial properties was growing. From their expertise, they knew that the available solutions for the realization of these materials were not suitable for large-scale application / adoption because of their harmful effects on humans, animals or the environment as a whole. They had foreseen the

dangers, the insecurities and the inconveniences of these solutions. More than four years of dedicated research has been invested in creating a 100% safe and biocompatible antibacterial technology for plastic with the use of a biomimetic approach in materials design and engineering. A team of 11 professors, scientists and researchers with decades of experience in the field of nanotechnology and biotechnology and specialized in chemical analysis and physic-chemical and microbial analyzes worked together with a renowned European university for chemistry. The discoveries and inventions made during this research are truly unique and revolutionary. In 2012, the first stages of commercialization of the discovered technologies were realized.

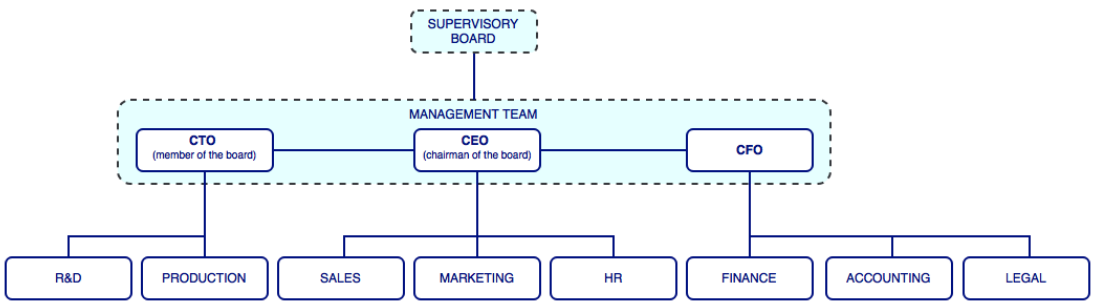
CHRONOLOGY OF PARX PLASTICS

The result of the years of effort are a very effective technology to create safe antibacterial / antimicrobial plastics with an antibacterial effectiveness rate of 99% measured according to ISO 22196. Antimicrobial manufactured materials using Parx Plastics technology are safe for humans, safe for pets, and safe for the environment.

Management

Michaël van der Jagt and Michele Fiori founded Parx Plastics. Two people oriented towards sales with a lasting cooperation that goes back more than 10 years. Michaël and Michele have been involved in a business relationship in multiple companies in the past and build an open relationship on trust and teamwork.

ORGANIZATIONAL CHART OF PARX PLASTICS



As an independent entrepreneur since 2002 in the field of computer components, **Michaël van**

der Jagt has developed a new brand for silent PC components that make computers quieter. These components produced in Asia were distributed in 26 different countries from the Netherlands. Then Michaël founded Designcord in 2010, which designs, develops and sells extension cable coils with the integrated automatic rewind function (like in vacuum cleaners). In 2013, Designcord had a turnover of more than 3 million euros and its products are marketed by Praxis, Office Center, Wal-Mart (Canada), Home Depot (United States), Lowe's (Mexico), Amazon (USA), Leroy Merlin (Italy), Tokyu Hands (Japan), etc.

Chemist, **Michele Fiori**, was first interested in computer science and its languages using Mandelbrot fractals as methods to bring TCP/IP protocols to communicate and control computers remotely. In 2003, he created a company to connect and market high-tech components produced in Europe, Asia and the United States. In 2010, he decided to change the structure of the realization of high quality brands in the portfolio. In 2012, he founded Parx Plastics with Michael Van der Jagt with the idea of revolutionizing one of the most used and interesting categories of raw materials in the industry and one of the most abundant materials open to innovation through to the incredible new technologies that exist.

Félix Guépin, joined Parx Plastics in September 2017, as financial director (CFO). After studying law at the University of Utrecht, Felix began his career in the Mergers and Acquisitions section of the law firm NautaDutilh. In 2006, Felix continued his career at Greenfield Capital Partners, a private equity firm, where he was involved in acquisitions and divestments. At the end of 2015, Felix was contacted by The ROOM to develop its services by introducing an innovative software product (Legal Artificial Intelligence), where he started in early 2016 as CEO.

Capital structure

At the date of this report, Michaël van der Jagt and Michele Fiori hold 81% of the shares of Parx Plastics, the rest of the capital is held by investors for 9% and by an investment fund, FF Ventriglia Investments & Finance Ltd for 10%. The following table presents the company's capital structure on an undiluted basis.

CAPITAL ALLOCATION

Names	Numbers of shares	% of capital et voting rights
Venor BV	2 700 000	39,6%
Quercus SRL	2 700 000	39,6%
Lausha NV	1 033 395	15,2%
Biotech Dental Smilers	300 000	4,4%
Roel Hartig	34 053	0,5%
FSOG VB (Felix Guépin)	43 134	0,6%
Total	**6 810 582**	**100%**

Intellectual Property

Like any innovative company, development and access to the market depends on its intellectual

property and therefore its patents. Parx Plastics therefore has a patent portfolio shown in the table below.

INTELLECTUAL PROPERTY OF PARX PLASTICS

Title: Antibacterial polymers and method for obtaining the same

Country	Patent Number	Filing Date	Status
PCT	PCT/IB2013/052491	28-03-2013	NATIONAL PHASES
ITALY	0001417006	28-03-2013	GRANTED 21-09-2016
CANADA	2,825,299	28-03-2013	GRANTED 22-12-215
CHINA	201310103486.7	28-03-2013	GRANTED 01-11-2016
USA	US 9,527,918 B2	28-03-2013	GRANTED 27-12-2016
EUROPEAN UNION	13723235.1	28-03-2013	PENDING
BRASIL	BR11 2015024640 0	25-09-2015	PENDING
SOUTH KOREA	10-2015-0138275	28-03-2013	PENDING

Source: Parx Plastics

The invention relates to polymers having antibacterial properties. The antibacterial effect is obtained by adding a zinc salt selected from: zinc PCA, zinc oxide, zinc hydroxide, zinc pyrrolinone or zinc pyrithione at the polymerization process of the monomers. These antibacterial polymers are used to prepare products intended to enter contact with the skin. The selected polymers are polypropylene (PP), polycarbonate (PC), acrylonitrile-butadiene-styrene (ABS), polyvinyl chloride (PVC) and polyethylene terephthalate (PET), nylon and polystyrene.

The intellectual property strategy adopted by the company is to protect its innovations by filing priority patents (cf. PCT thanks to international requests), which gives Parx Plastics optimal territorial protection while considering the cost constraints and the schedule of each project. The objective of this international protection strategy is to obtain optimal territorial protection while considering the cost constraints and schedule of each project.

The Market

World consumption of plastic biocides was estimated at US $ 145 million at the active manufacturing level in 2006, a 40% increase over 1996. This performance reflects not only the growth of the industry, regulatory and technological changes, but also the increasing use of biocides hygiene material. Biocides in Plastics market will continue to grow due to the use of more polymer types and the replacement of traditional biocides with more expensive environmental biocides. Specialty biocides include bactericides and fungicides. North America accounted for about 40% of this total. But several factors combine to bring back the total value of the market and the percentage in North America. Countries such as China, Eastern Europe, India and South America continue to offer growth opportunities by increasing per capita income and placing more emphasis on human health issues. Biocide producers will rely more on specialized niches that are growing within the hygiene sector. With mature markets in major consumer regions and generic products beginning to affect the market environment, specialty niches will provide a cost-effective outlet for active ingredient manufacturers.

A recent study by Biocides Information Ltd entitled "Biocides in plastics" of March 2017 assesses the $ 197 million market for biocidal active ingredients. The breakdown by geographical area shows that Asia-Pacific is leader with the sales of 81 million dollars followed by North American, with 67 million dollars and Europe with 49 million dollars.

The market estimates for antimicrobial plastics are rather disparate. Some marketing research firms such as Allied Market Research, show this market is expected to reach a value of just over $ 57.8 billion by 2020, with an annual growth rate of 4.4% in the 2013-2020 period. . On the other hand, Technavio, another marketing research firm shows the segment of antimicrobial additives would represent in 2021 worth a little more than 5 billion dollars. Within this market, the share of antimicrobial plastics in 2016 was 1.32 billion dollars. While for MarketsandMarkets, the value of the antimicrobial plastics market is expected to grow more than 8% (TCAM: 8.7%) over the 2015-2020 period, reaching a little over 16 billion dollars in 2020. Mainly driven by the Asia-Pacific region, which is today the most important market for the use of antimicrobial plastics. But this growth is also due to the great diversification of biocide uses both in everyday life and in the industry. All experts agree that this leadership position for APAC will continue as the Asia-Pacific region.

Competition

Competition in the antimicrobial market is important. Manufacturers of ingredients, formulators and producers of polymers should be distinguished. Among the thirty identified active ingredient producers, there is a mix between multinational companies like Dow or BASF and smaller entities. Dow, the leading antimicrobial sales leader, has a turnover of 20 million dollars. Dow makes a large part of its turnover with DCOIT, the ILO and OBPA. Troy, which produces IPBC and OBPA, is also a leader in the production of active ingredients with 13 million dollars. Troy commercializes the Micropel brand for OBPA formulations, antioxidants. Biocidal or antimicrobial formulators include companies such as Aglon, Akcros, Bactiguard, Microban, NanoHorizons and Sanitized. The price increases vary greatly within this segment, as price increases could range from 60% in the preservation of surfaces to 400% for medical devices when the biocide supplier is able to support its claims by regulatory, technical and formulation data from regulatory agencies such as the FDA, the EMA or the French ANSM. Some formulators may also license their customers, granting them the right to affix quality labels such as Microban, Sanitized or Ultrafresh. It is not uncommon, especially in the field of medical devices that customers establish partnership agreements with formulators. About 20% of antimicrobials are marketed by polymer masterbatches, which incorporate active ingredients into their polymers and sell them to plastic processors. Among these polymer producers are large companies from the chemical industry such as BASF, Bayer Material Sciences, Ticona and Victres. Addmaster, A. Schulman, Clariant, Biosafe, Milliken, Polychem Alloy, RTP and Wells Plastics are some of the masterbatch producers. These latter emerged when finished plastic producers, did not have the infrastructure or the staff to develop antimicrobial solutions, and chose to focus solely on production, creating a strong dependency.

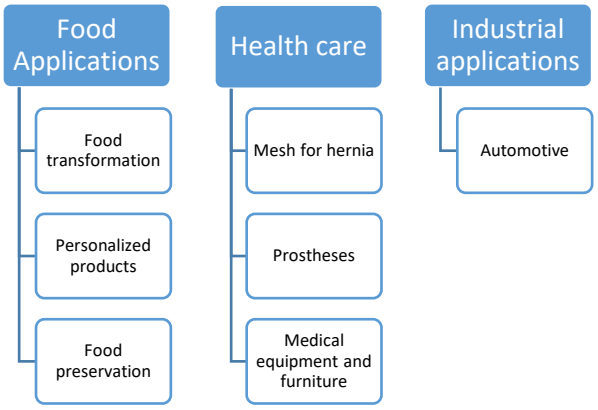
Target markets of Parx Plastics

The properties (environmentally friendly, non-toxic, cost-effective and efficient) of the products developed by Parx Plastics mean that the fields of application are multiple.

We will distinguish:

1. Food applications;
2. Medical and health applications;
3. Industrial applications;
4. Others

POTENTIAL APPLICATIONS



Medical and health applications

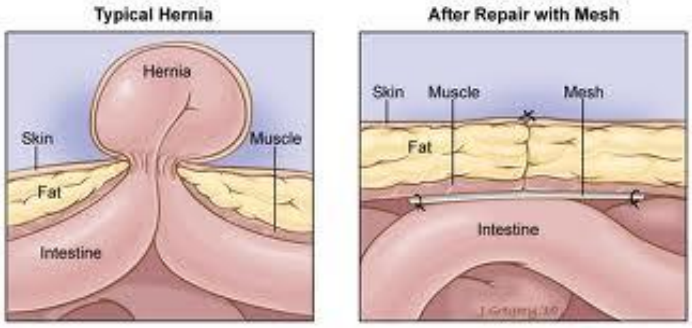
Healthcare-associated infections (IAS or HAI) or nosocomial infections have become a growing concern for health systems, regulatory agencies, industry and the public. The emergence of certain forms of resistance of bacteria to the traditional arsenal, antibiotics associated with the reduction of disinfection time due to the reduction in staff of medical institutions raise concerns on the share of health care users. A recent study from the CDC (Centers for Disease Control and Prevention), reported more than 722,000 cases of IAS (infections associated within care) in intensive care hospitals in the United States in 2011. Approximately 75,000 patients with HAI (Hospital Associated Infections) died during their hospitalization. In addition, the cost of these patients represents a real burden for healthcare system. One of the first applications for Parx Plastics' technology would most likely be the plastic mesh used in hernia reduction.

Hernias

Incisional hernia is the most common complication of laparotomy that requires re-operation. Recent figures cite an overall incidence of almost 10% [22] of the population. So, the data shows that two million laparotomies are performed each year in the United States [23], an estimated 200,000 patients require incisional hernia repair each year.

For stomatal hernias, the incidence of hernia formation can reach 30%, and when surgical site infections occur, the incidence can double [24]. The costs of an incisional hernia repair surgery are significant. Poulose et al. calculated an average cost of $ 15,899 for each transaction in the United States in 2006, which represents approximately $ 3.2 billion per year.

HERNIA REPAIR MECHANISM



Non-incisional hernias share many aspects of their pathophysiology and management with incisional hernias. However, the repair of incision-free abdominal wall hernias is now a strong trend for general surgeons, with more than one million procedures per year in the United States [25]. These hernias show a prevalence of 1.7% in the general population, reaching up to 4% in people over 45 years. Inguinal hernia, which accounts for 75% of these occurrences, carries a lifetime risk of 27% in men [26] .

Prosthetic meshes are widely used to reduce recurrence rates of hernias. Indeed, studies show that the recurrence rate at 10 years for incision-treated hernias is 63% without mesh and 32% for repairs using a prosthetic mesh [27]. While meshes are obviously beneficial, they remain associated with several serious complications, including the recurrence of a hernia, the infection [28], chronic pain and adhesions.

Surgical and medical instruments

The market for plastic medical devices is growing rapidly. Various studies have shown that these medical device markets had growth of 15% in Asia, 10-12% in America and 6-8% in Europe in 2009 and 2010. Although medical devices may have very different design and usage characteristics, some factors determine the sensitivity of a device to microbial contamination and biofilm formation: duration of use, number and type of organisms to which the apparatus is exposed, flow rate and composition of the medium in or on the apparatus, construction of the apparatus and conditioning films on the apparatus.

Over the past decade, several studies have investigated the ability of implant surface modifications to minimize bacterial adhesion, inhibit biofilm formation, and kill bacteria to protect implanted biomaterials. We can distinguish the following elements:

1. Passive surface finishing / modification (PSM): passive coatings that do not release bactericidal agents into surrounding tissues, but that aim to prevent or reduce bacterial adhesion through chemical and / or structural modifications;
2. Active Surface Finishing / Modification (MSA): active coatings that contain pharmacologically active pre-incorporated bactericidal agents;
3. Carriers or local coatings (LCC): local or non-biodegradable antibacterial carriers or coatings, applied at the time of the surgical procedure, immediately before or at the same time as and around the implant.

The classification of different technologies can be useful for better comparing different solutions, improving the design of validation tests and, hopefully, improving and speeding up the regulatory

process in this rapidly evolving field.

According to Grand View Research, the global market for medical device coatings was $ 7.51 billion in 2015 and is expected to grow due to high use in catheters, stents, guides, syringes, sutures and mandrels. There is an increase in the demand for devices treated with antibacterial components due mainly to the multiplication of diseases and the increasing demand for hydrophilic lubricant coatings in ducts, several cardiovascular and urological catheters and short-term implanted devices to induce biocompatibility stimulate the development of the industry over the next nine years

Antimicrobial coatings accounted for 40.6% of the overall volume and are expected to show significant growth due to their low cost and high compatibility with various materials such as metal, plastic, carbon fiber, composite materials, plastics and stainless steel. In addition, the increase in R&D activities and the increasing use of implantable devices will stimulate growth.

Hydrophilic coatings are expected to post the fastest sales growth with a CAGR of 7.9% between 2016 and 2025 due to widespread use in medical devices, including pacemakers. General surgery was the predominant segment in 2015 and accounted for 25.3% of the global volume. Increasing the use of the product in various parts, including the processor, graphics cards, hard drives and chipsets, will increase the size of the industry. Rapid urbanization, rising incomes and changing lifestyles will further increase the industry's expansion.

Prostheses

In 2012, osteoarthritis affected 27% of the population in industrialized countries over the age of 45 and this rate is expected to increase by 11% by 2032, while today 26,000 people / per million inhabitants will be affected. The OECD estimated that there were just little under 1.5 million knee replacements in 2011 in OECD countries. Among these patients, the highest incidence of osteoarthritis is found in the knee joint, which is affected twice as often as the hip joint [29]. Although there are patients with asymptomatic arthritis, the need for genitating arthroplasty will grow exponentially [30]. Obesity is a major factor in a growing demand for knee replacement surgery [31].

There are strong disparities between countries. Germany, Switzerland and Austria have a high rate of hip and knee replacement. The United States and Germany have the highest rate of knee replacement, although the US population structure is much younger than that of Germany.

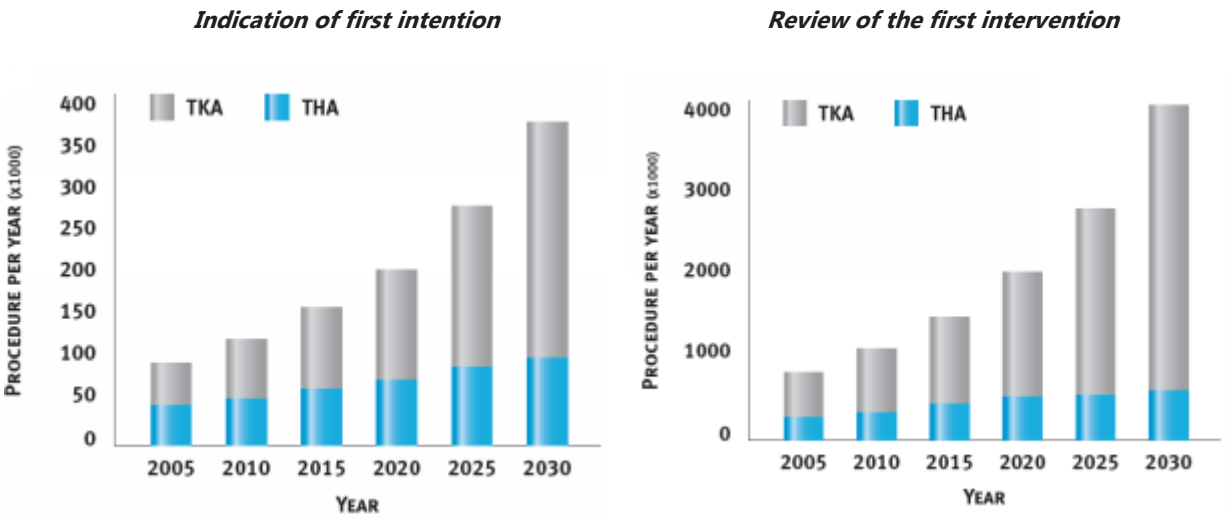
The variation in the growth rate between the different OECD countries is considerable: Korea, Poland, Portugal and Slovenia show a growth rate of more than 13% in each age group. Patients aged 64 and under have a significantly higher annual growth rate of 7.1% than patients aged 65 years and over with a rate of 4.4%. Several reasons may explain inter-country variations in hip and knee replacement rates, including: i) differences in the prevalence of osteoarthritis problems; ii) differences in the ability to deliver and pay for these expensive procedures; and iii) differences in clinical treatment guidelines and practices.

The incidence of first-line hip and knee replacements has increased significantly both in the USA (as shown in the figures below) and in the rest of the world. Factors such as awareness of the medical benefits of joint replacement surgery, obesity, increased "senior" population and co-morbidities are leading to a substantial increase in the demand for hip and knee joint replacement. Kurtz et al. reported a significant increase in primary revision (50%) and revision (8.2%) rates of total number of knee replacements between 1990 and 2002 in the United States [32]. In addition,

Ong et al. reported that MEDICARE allocated 8% of its annual budget to expenses associated with the TKA (Total Knee Arthroplasty) revisions from 1997 to 2003 [33]. By 2030, the demand for total hip and knee replacements is expected to increase by 174% (572,000 surgeries / year) and 673% (3.5 million surgeries / year) revision of respectively 137% and 601% [34].

Joint replacement surgery or hip and knee replacement surgery is the most effective intervention for severe osteoarthritis, reducing pain and disability and restoring some patients to near normal function. Indeed, according to WHO, osteoarthritis is one of the ten most disabling diseases in developed countries. According to the WHO, 10% of men and 18% of women over 60 have symptomatic osteoarthritis, including moderate to severe forms. The aging of the world's population is certainly the strongest predictor of the development and progression of osteoarthritis. It is more common in women, increasing after the age of 50, especially in the hand and knee. Other risk factors include obesity, physical inactivity, smoking, excess alcohol and injuries.

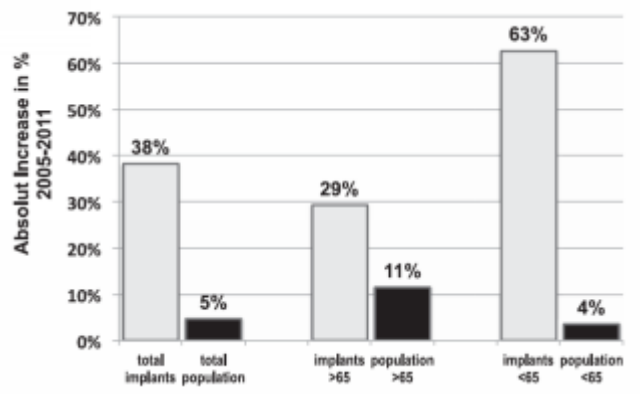
EVOLUTION OF HIP AND KNEE REPLACEMENT PROCEDURES IN THE US BETWEEN 2005-2030



Source: Zimmer® Computer-Assisted Surgery in Total Knee Arthroplasty, Value File

Implant-related infections are the result of a complex interaction of various factors, including bacterial load, type of microorganism and host, surgical procedure and technique, and type of implant and prophylaxis antibacterial. In fact, even elective surgery ("cold" surgery) may not be performed in a completely sterile environment, and operating rooms have shown to be contaminated during the first few hours of service. While in most cases the relatively low bacterial burden that may be present at surgery may be generally overcome by immunological defense of the host and systemic antibiotic prophylaxis, in some patients an SSI may eventually develop, particularly in high risk patients.

INCREASED KNEE REPLACEMENTS BETWEEN 2005-2011 BASED ON PATIENT AGE

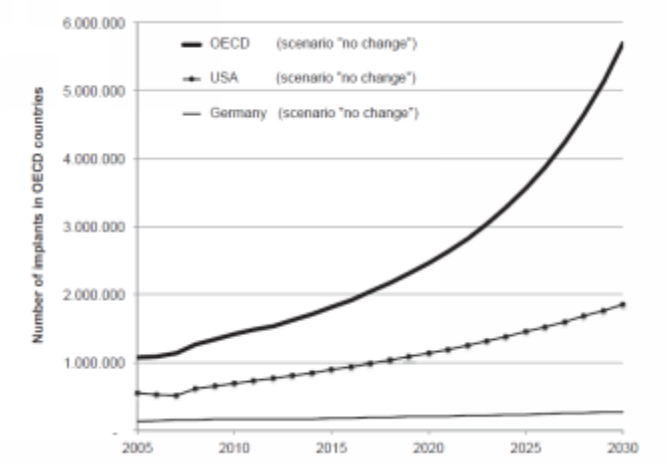


Source: C. Pabinger, H. Lothaller, A. Geissler. Osteoarthritis and Cartilage 23 (2015) 1664-1673.

Although the risk of infection in patients undergoing joint arthroplasty is low, the increase in these procedures automatically leads to an increase in this low risk that can lead to a substantial level of infection. In Europe, particularly for countries participating in the ECDC surveillance network (European Center for Disease Prevention and Control), infections of surgical sites rates are 0.8% and 1.2%, respectively for patients with knee surgery and patients with hip surgery.

While implanted biomaterials play a key role in the current success of orthopedic and trauma surgery, implant-related infections remain among the main reasons for failure. According to current knowledge, the most critical pathogenic event in the development of an implant-related infection is biofilm formation, which begins immediately after bacterial adhesion to an implant and effectively protects the microorganisms against the immune system and systemic antibiotics. Prevention of infections associated with biomaterials should then specifically focus on inhibition of bacterial adhesion and biofilm formation.

SCENARIO OF FUTURE CHANGES IN THE NUMBER OF PROCEDURES FOR THE KNEE



Source: C. Pabinger, H. Lothaller, A. Geissler. Osteoarthritis and Cartilage 23 (2015) 1664-1673.

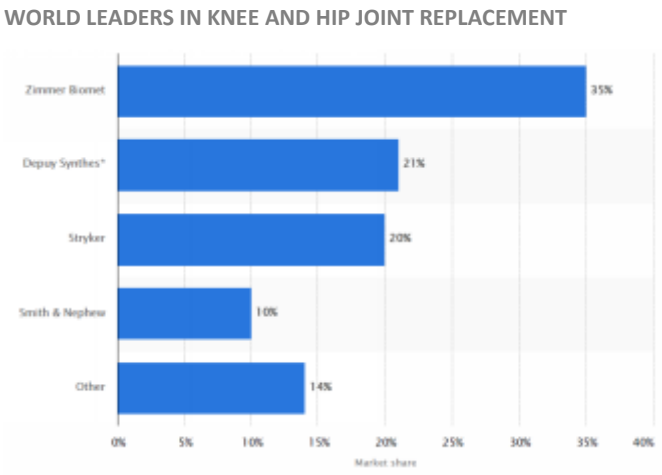
Due to previously mentioned factors (economic growth, more implants for younger patients, increased obesity and life expectancy) there is expected to be an exponential increase in knee replacements with 5.7 million implants used in 2030. This increase is similar to Kurtz et al's simulations for hip and knee replacements for the US [35]. These values are also comparable to

the predictions of an increase in hip arthroplasty in Sweden by 2030 [36]. Another study also reported excessive use of knee implants in patients who were 45-64 years old, but the rapid expansion of total knee replacement use cannot be fully explained by changes in the size of the population and the prevalence of obesity alone. Therefore, the data suggest that other factors, including widening indications (more sports-related injuries, greater demand by direct-to-consumer advertising) for total knee replacement and changing patterns of total use knee replacement among those with OA, are involved [37].

Although current perioperative infection prevention methods, such as antibiotic prophylaxis, have significantly reduced the incidence of surgical site infections, up to 2.5% of primary hip and knee replacements and 10% of knee revision surgeries can still be complicated by joint infection. Moreover, according to a recent analysis, these figures could even be underestimated and increasing, while multi-resistant pathogens are often more and more present. The occurrence of PJI is a devastating complication, often requiring the removal of the implant, with high morbidity associated with high economic and social costs.

Strengthening concentration in orthopedics

Large players dominate the global orthopedic market, estimated at $ 34 billion. A group of 5 in the US controls 65% of the orthopedic implants market while subcontracting to 50%. For knee and hip replacements, Zimmer Biomet, which generates $ 2.3 billion with this activity, is in a leadership position with 35% of the market. In 2016, Zimmer bought Biomet for $ 14 billion. DePuy Synthes, the J & J subsidiary has 21% of the market and ranks second. DePuy / J & J bought Synthes in 2012 for $ 21.3 billion or 5.8x the 2010 revenues and 23.5x the 2010 net income). These two operations have further accentuated the concentration of the sector. This situation has the effect of reducing the number of potential customers for Parx Plastics in the field of orthopedics



Source: Statistica.

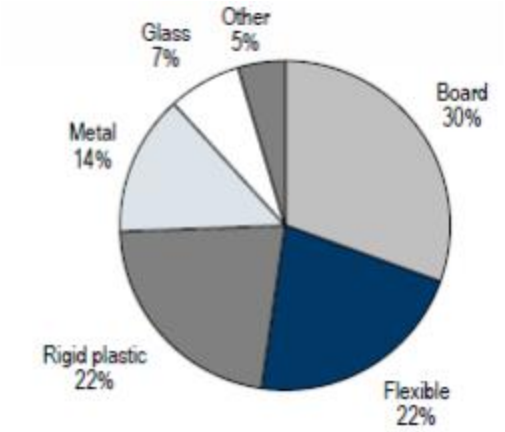
Food applications

Food preservation, quality maintenance and safety are growing concerns of the food industry. Consumers also demand safe, natural food products with strict regulations to prevent food-borne infection diseases. Antimicrobial packaging that is considered a subset of active packaging and/or controlled release packaging is a promising technology. The technology consists of effectively impregnating the antimicrobial material into the food packaging film material and then dispensing it during the stipulated period to kill pathogenic microorganisms affecting the food products and thus increasing the shelf life. The development of resistance among microorganisms is considered a future involvement of antimicrobials to achieve real efficiencies by extending the shelf life and reduced bacterial growth through the next promising use antimicrobials in food packaging.

Patterns of food consumption have been profoundly altered as more and more foods are prepared and tasted outside the home. In 1970, the proportion of food produced and consumed outside the home was 25.9%. In 2012, it reached 43.1% [38].

Smithers Pira, a market intelligence firm specialized in packaging, the global packaging market was estimated in 2015 at $ 839 billion, up 3% from 2014. It is characterized by certain stability. Estimates predict that it could reach $ 1 trillion in 2020. This growth is driven by the development of some countries such as China, which is changing its social, cultural and food behaviors. Moreover, one of the engines of growth is also innovation, offering opportunities for differentiation to industry players. For example, it involves improving the protection of the packaged product, extending the shelf life, changing the design to attract the attention of customers. The innovation is also to improve the environmental footprint of the packaging through the development of less demanding packaging CO_2 (less raw material and lower transportation costs) and recycling.

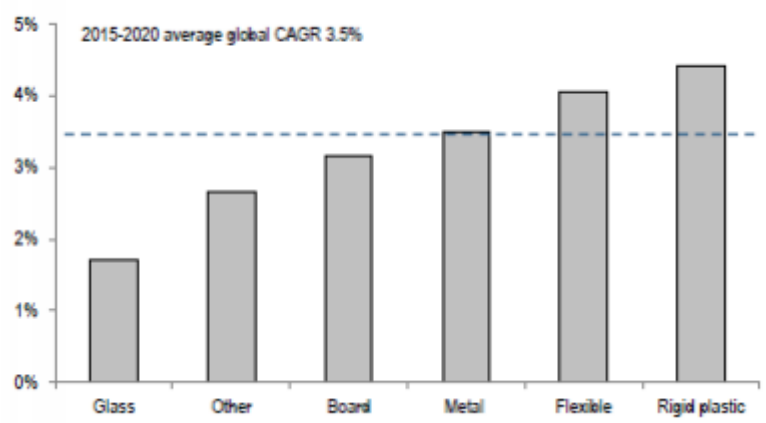
MARKET SHARE OF DIFFERENT TYPES OF PACKAGING IN 2014



Source: Smithers Pira, Credit Suisse Research

According to Smithers Pira, metal packaging accounts for 14% of the total revenue of the packaging industry and has a growth rate of 3.5% between 2015 and 2020. Rigid plastics, which account for 22% of revenues in the packaging market, exhibit a growth rate of 4.4%, higher than that of the entire sector as well as flexible plastic packaging (cf. figure below). On the other hand, glass packaging (7% of total revenues of the packaging industry) has the lowest growth rate at 1.7% over the 2015-2020 period. Emerging markets should record a rate of 5.5% between 2015-2020, while Europe is expected to grow by around 3.6%/year over the same period.

REVENUE GROWTH (2015-2020) BY TYPE OF PACKAGING



Source: Smithers Pira, Credit Suisse Research

The market for antimicrobial additives for food packaging, which is a subset of the packaging market, was estimated by Terpco at $ 250 million in 2015 and is expected to grow between 6.5% and 7% over the 2016 period at 2022.

Industrial applications

The size of the automotive plastics market for passenger cars is expected to reach $ 16.17 billion by 2020, from $ 9.86 billion in 2014 to an expected CAGR of 8.7% between 2015 and 2020. The high growth rate of the industry can be attributed to consumer awareness of the importance of plastics with antimicrobial properties. This should provide a boost to global demand for antimicrobial plastics in packaging and healthcare applications. The main drivers of this market are increasing consumer awareness of nosocomial infections, as well as outbreaks of life-threatening diseases such as H5N1 avian influenza and H1N1 swine flu. As a result, there is increasing consumer awareness of the importance of antimicrobials in plastics. The market is small due to various factors, such as the volatility of the raw material process, which increases the overall cost of existing products, which significantly affects the profit margins of the manufacturers. According to the International Organization of Motor Vehicle Manufacturers (OICA), new registrations and sales increased by 4.8% to reach 65.9 million in 2016.

NEW REGISTRATIONS AND SALES IN KEY MARKETS

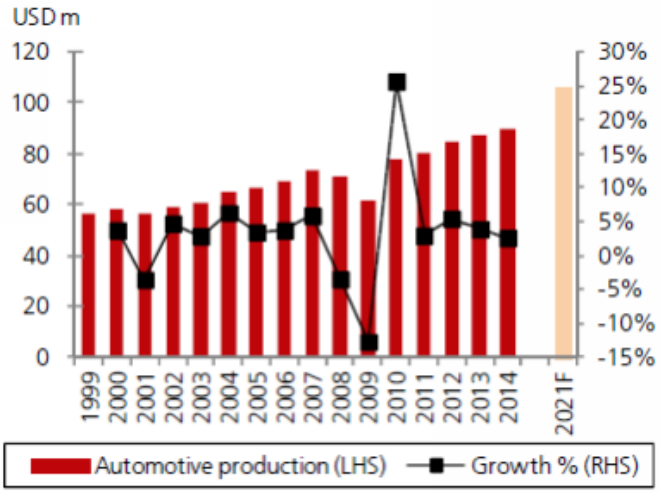
Marché	Ventes 2015	Ventes 2016	TACM 3 ans	Part de marché
Chine	21,2 m	24,4 m	10,80%	35,10%
Europe	16,4 m	17,3 m	0,10%	24,90%
USA	7,5 m	6,9 m	1,30%	9,90%

Source: OICA, DBS Bank.

Between 2014 and 2020, the amount of plastic per vehicle is expected to increase by 75%. This growth is mainly due to the replacement of many metal parts with plastics, the aim being to reduce the weight by around 50%. Moreover, the amount of plastic incorporated on average has doubled since the 90s. The production of an automobile generally requires more than 200 plastic parts for the passenger compartment produced for the majority by injection. IHS estimates show that, on average, a car is expected to incorporate nearly 350 kg of plastic in 2020 versus "only" 200 kg in 2014. According to the China Die & Mold Association, 2 to 3 kg of metal can be replaced

by 1 kg of plastic. This "heavy " trend in the automotive industry is expected to continue in the coming years in both mature and developed markets, as well as in more emerging markets such as China. The American Council of Chemistry (ACC) estimates that a 10% reduction in the weight of vehicles could lead to a fuel economy of 6 to 8%.

WORLDWIDE PRODUCTION OF VEHICLES



Source: OICA, DBS Vickers Securities.

In addition, the regulation requirements in terms of fuel consumption, requires that more efficient vehicles to reduce emissions of greenhouse gases, should further strengthen the use of plastics in vehicles. Overall vehicle production is expected to increase from 58.4 million to 89.7 million vehicles with a cumulative growth rate of 3.12% between 200 and 2014. According to IHS Markit, a market intelligence firm specializing in the automotive industry, the number of vehicles produced is expected to reach 106 million by 2021. According to IHS, Europe's share would increase by 4% per year between 2015 and 2017. MarketsandMarkets predicts that between 2015 and 2020 plastics consumption in the automotive industry is expected to grow by 10.9% per year to reach $ 40.1 billion.

Parx Plastics: marketing strategy

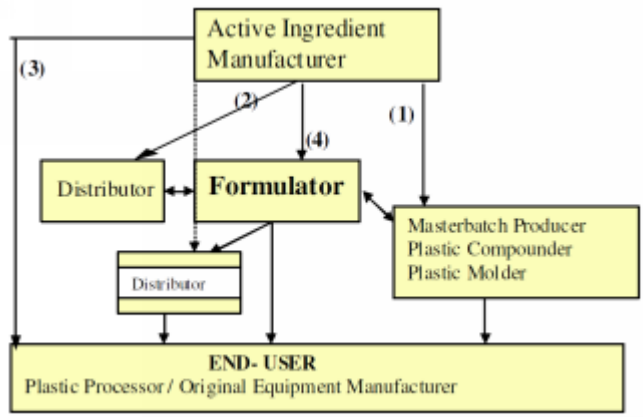
Distribution channel

The distribution of biocides to end-users is relatively complex as can be seen in the figure below. The traditional way of marketing biocides is through

1. This pathway illustrates how active ingredient manufacturers can supply masterbatch producers, plastic manufacturers and plastic injectors. This route represents 10% of sales.
2. Track No. 2, which accounts for 20% of sales, provides ingredients to end-customers through distributors who can resell them to formulators alike.

3. In Route 3, ingredient manufacturers sell nearly 30% of their production directly to final customers, such as processors and producers of medical equipment (see Micropel purchases by Troy and Morton by Dow).
4. Track 4 illustrates the direct use of formulators in plastic processors and equipment manufacturers. This channel accounts for almost 40% of sales of producers of active ingredients.

DISTRIBUTION OF BIOCIDES IN THE PLASTIC INDUSTRY



Source: Biocide Information; Report Biocides in Plastics 2017

Marketing Strategy

Based on our market analysis outlined above, Parx Plastics' marketing strategy has three components:

1. Direct marketing in Europe
2. A distribution agreement with Nexeo Solutions signed in 2015 renewable in 2018 covering Europe. Nexeo Solutions generated $ 474 million in EMEA (European market), which represents 12% of the company's total revenue. The focus of Nexeo Solutions in Europe is mainly on plastics, with 8 sales offices. Nexeo Solutions' global business in plastics generated $ 1,856 million.
3. A joint venture between Parx Plastics and Chinese investors was registered in September 2017 under the name Ningbo Parx New Materials Technology Co., Ltd. Parx Plastics has 40% of the shares and Chinese investors (60%). The Chinese investors consists of the Yuyao Province government, which would contribute $ 5 million, from a company listed on the Chinese market, which would pay for $ 2 million and private investors for $ 3 million. This $ 10 million is for the establishment of a production unit in China.
4. The US market is not targeted for a few years: Parx Plastics is waiting to set up its second production unit, this time in Europe.

Anticipated income

The Parx Plastics business model combines direct sales and distribution in Europe and a joint venture with a Chinese partner in Asia (the continent that is currently showing the strongest growth in specialty plastics, particularly antimicrobial plastics) a model that limits the risk associated with the technology and its applications. The flows should come from:

- For Europe: sales made by the distributor as well as direct sales by Parx
- For Asia and especially China, sales by the joint venture Ningbo Parx New Materials Technology Co., Ltd. Moreover, the supply of the Chinese market, let alone the Asian market, will be provided by the plant Ningbo Parx New Materials Technology Co, Ltd, to be built and whose construction is expected to begin in 2018.

The contract with Ningbo as well as the joint venture that will be finalized in the first half of 2018 foreshadows other contracts that can be envisaged by 2019 in other territories such as North America. The short-term profitability is affected by the investments necessary to produce Sanipolymers (factories, development of new formulations) as well as the marketing activities necessary for their commercialization.

SIMPLIFIED INCOME STATEMENT

	2104	2015	2016	2017	2018e	2019e	2020e	2021e
Revenues	26 299	103 134	179 365	346 906	471 475	1 004 750	2 009 500	4 019 000
variation		*74,5%*	*73,9%*	*93,4%*	*35,9%*	*113,1%*	*100,0%*	*100,0%*
Gross Margin	15 364	30 370	128 753	245 881	330 033	703 325	1 406 650	3 215 200
Gross margin (%)		*29,4%*	*71,8%*	*70,9%*	*70,0%*	*70,0%*	*70,0%*	*80,0%*
Operating Income	(75 310)	(293 711)	(253 060)	(76 839)	(88 757)	(128 754)	(201 884)	1 141 546
Operating Margin (%)		*-284,8%*	*-141,1%*	*-22,1%*	*-18,8%*	*-12,8%*	*-10,0%*	*28,4%*
Net Income	(92 132)	(292 790)	(253 127)	(76 861)	(88 757)	(128 754)	(201 884)	1 141 546
Operating Margin (%)		*-283,9%*	*-141,1%*	*-22,2%*	*-18,8%*	*-12,8%*	*-10,0%*	*28,4%*

Source: Parx Plastics and Aurgalys estimates

Evaluation

Parx Plastics is expected to generate regular cash flows after starting the marketing of Saniconcentrate ™ and ramping up sales. These prospects and the international development of Parx Plastics make it relevant to use a DCF model. For the valuation of Parx Plastics, we used the traditional method of discounting cash flows (DCF method). For the record, we mention the multiple transaction method for acquisitions in the sector, because this sector is particularly rich in acquisitions and sometimes based on high multiples.

Valuation using the DCF method

Our assumptions are as follows:

- Doubling sales over the period 2018-2020, which seems almost assured after the progression of 2017 and following the various agreements that Parx Plastics has been able to establish with its distributors and its Chinese joint venture.
- Sales growth over the period 2021-2022 of 50% supported by the rise of Chinese activity, particularly following the establishment of the production unit headed by the joint venture and the ramp-up of the Chinese market.
- Starting in 2023, our model forecasts a slowdown in sales growth to reach 22%.
- The gross margin of 82.5% in 2017 is maintained over the period of our model at these levels, because the company intends to approach a number of markets in particular European.
- The tax rate of 30%.
- The discount rate: we retained a beta 2.5 higher than that of companies in the plastic and specialty chemicals industry, most of them American and Indian. The reasons that led us to increase this beta are because:

1. The company is still relatively early in its development (for creation in 2012);
2. The use of zinc as a trace element is a "radical" innovation that is expected to displace several other antibacterial products in plastics;
3. The establishment of the commercial network of Parx Plastics could take some time especially in Europe
4. The construction of the Saniconcentrate™ and Sanipolymers™ production plants, which is expected to accompany the ramp-up, have not yet been built.

Cost of capital	**17.81%**
Risk free rate	0.76%
Economic active beta	2.5
Risk premium	6.82%

SUMMARY OF CASH FLOWS FROM 2018 TO 2027

	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	2026e	2027e
Revenues	471 475	1 004 750	2 009 500	4 019 000	6 028 500	9 042 750	12 444 300	15 266 813	18 737 241	22 997 003
Revenues growth	*111,61%*	*100,00%*	*100,00%*	*50,00%*	*50,00%*	*38,37%*	*22,45%*	*22,50%*	*22,50%*	*20,00%*
EBITDA	-83 944	-103 634	-196 827	1 146 730	1 746 631	2 647 810	3 665 025	4 508 365	5 545 909	6 820 075
as % of revenues	*-16,32%*	*-18,92%*	*26,15%*	*43,23%*	*56,64%*	*62,69%*	*66,29%*	*69,24%*	*71,67%*	*73,43%*
EBIT	-88 757	-108 567	-201 884	1 141 546	1 741 318	2 642 364	3 659 442	4 502 643	5 540 045	6 814 064
as % of revenues	*-16,99%*	*-19,28%*	*25,98%*	*43,11%*	*56,56%*	*62,63%*	*66,24%*	*69,20%*	*71,64%*	*73,40%*
Normative tax									-1 662 013	-2 044 219
Depreciations	4 813	4 934	5 057	5 184	5 313	5 446	5 582	5 722	5 865	6 011
Investments	0	(15 000)	0	0	0	0	(2 487 000)	0	0	0
Net change in assets	4 813	-10 066	5 057	5 184	5 313	5 446	-2 481 418	5 722	5 865	6 011
Variation of WCR	24 914	106 655	200 950	401 900	401 900	602 850	680 310	564 503	694 086	851 953
FCF	**(118 485)**	**(235 156)**	**(407 891)**	**734 463**	**1 334 105**	**2 034 068**	**486 550**	**3 932 419**	**3 178 081**	**3 911 881**
Discounted FCF	**(100 573)**	**(169 431)**	**(249 458)**	**381 277**	**587 867**	**760 804**	**154 473**	**1 059 748**	**726 985**	**759 563**

Source: Parx Plastics and Aurgalys estimation

SENSITIVITY OF PARX PLASTICS' VALUATION TO DISCOUNT RATES AND GROWTH TO INFINITY

SENSITIVITY TABLE

	16,81%	17,31%	17,81%	18,31%	18,81%
1%	26 913 042	25 217 687	23 654 561	22 211 001	20 875 810
1,25%	27 308 094	25 575 549	23 979 399	22 506 432	21 144 990
1,50%	27 716 218	25 944 886	24 314 341	22 810 788	21 422 072
1,75%	28 138 065	26 326 252	24 659 860	23 124 471	21 707 404
2%	28 574 330	26 720 236	25 016 458	23 447 911	22 001 354

Source: Aurgalys Estimate

The pre-money valuation of Parx plastics using the DCF method under the previous assumptions is € 24.31 million.

Transaction Multiplies Approach

Mergers and acquisitions activity is relatively important in this sector, as many innovative companies providing radical or incremental innovations represent targets of interest to large groups. We quote the transactions made in history.

COMPARABLE TRANSACTIONS

Date	Cible	Description de la cible	Acquéreur	VE	VE/CA	VE/EBITDA
Juin 2017	Adchem Corp	Fabricant de bandes adhésives	Berry Global Group	49	-	-
Aout 2016	AEP Industries	Emballage	Berry Global Group	705,4	0,60 x	6,70 x
Juillet 2015	AVINTIV Inc	Emballage	Berry Global Group	3 754,3	2,00 x	19,00 x
Mars 2014	Rexam plc Containers	Cannettes en métal et emballages plastiques	Berry Global Group	135	-	-
Aout 2013	Fiberweb Plc	Emballage	The Blackstone Group L	260,3	0,60 x	6,30 x
Novembre 2012	Superior Multi Packaging	Cannettes en métal	Crown Asia Pacific Holdings	65,0	0,50 x	9,50 x
Novembre 2012	Bway Parent Co Inc	Cannettes en métal et emballages plastiques	Platinium Equity LLC	1 240,0	1,10 x	7,40 x
Octobre 2013		Plastiques rigides	Berry Plastics IPO	5 956,0	1,20 x	7,10 x
Mars 2012	Esk	Cannettes en métal	National Can Industries	A$ 87,6	0,60 x	5,80 x
Juillet 2011	Pro Pac Packaging	Plastiques rigides	Bennamon Pty Ltd	A$ 78,8	0,60 x	6,60 x
Juin 2011	Dynaplast tbk PT	Plastiques rigides	Dynapack Asia	231,8	1,20 x	7,30 x
Avril 2011	Graham Packaging	Plastiques rigides	Rank Group	4 365,1	1,50 x	7,50 x
Juin 2010	Balls Plastics Packaging	Plastiques rigides	Amcor	280,0	0,50 x	4,00 x
Juin 2007	O-I Plastics	Plastiques rigides	Rexam	1 725,0	2,30 x	10,70 x
Mars 2007	CVC Capital Partners	Plastiques rigides	Zhuhai Zhongfu	1 004,7	2,00 x	13,90 x
			Moyenne		1,13 x	8,60 x
			Médiane		1,10 x	7,30 x

Source: Aurgalys after FactSet

To illustrate the above, we can take the case of Berry Global Group. Indeed, this group has carried out several transactions in the sector, we see that this company is at the origin of 4 successive transactions in the field of specialty plastics, considered strategic steps Berry Global Group, allowing it to position itself in the field of packaging by acquiring essential skills.

Financials

Assets (M€)	2014	2015	2016	2017	2018e	2019e
Fixed Assets	0,03	10,02	10,04	10,03	8,53	7,25
Accounts	0,09	0,03	0,06	0,04	2,40	4,28
Cash & equivalents	0,01	0,01	0,01	0,01	0,03	1,46
Total Assets	**0,12**	**10,06**	**10,12**	**10,23**	**10,99**	**12,99**

Liabilities (M€)						
Stockholder's equity	(0,05)	9,52	9,58	9,46	9,51	9,58
Allowances	-	0,18	-	-	0,25	0,19
Suppliers	0,13	0,15	0,18	0,17	0,44	1,00
Liabilities	0,00	-	0,00	0,00	0,62	0,98
Others Liabilities	0,04	0,18	0,36	0,53	0,18	1,25
Total Liabilities	**0,12**	**10,06**	**10,12**	**10,23**	**10,99**	**12,99**

Income Statment (€M)	2014	2015	2016	2017	2018e	2019e
Revenues	0,03	0,10	0,18	0,35	0,47	1,00
EBIT	(0,08)	(0,34)	(0,30)	(0,12)	(0,04)	0,33
Net Income	**(0,10)**	**(0,35)**	**(0,31)**	**(0,13)**	**(0,05)**	**0,32**

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