

MANUFACTURING PALLETS FROM PLASTIC CAPS

Marcus Vinicius Rezende Júnior, Federal University of Uberlândia, School of Mechanical Engineering,
marcus_aluno7@yahoo.com.br

Joseph Gavaille, National Engineering Institute in Mechanics and Microtechnologies, joseph.gavaille@ens2m.fr

Marie-Thérèse Millet, Les bouchons d'Amour non-profit organization, mmretmmemillet@sfr.fr

Nathalie Boudeau, National Engineering Institute in Mechanics and Microtechnologies,
nathalie.boudeau@ens2m.fr

Abstract: About 300 million tons of plastic were produced worldwide in 2013, close to nine kilograms of plastic per second, consuming about 8 % of global oil production. In a general way, only 25% of this plastic amount is recycled. Plastic in the oceans is an environmental disaster for marine wildlife. 80% of ocean waste is composed of plastic (bottles, filters, industrial pellets, pens, packaging, bottle caps, etc.). According to the Algalita foundation, about 100 million tons of plastic were dumped in the ocean in a century. This paper aims to discuss about how plastic caps can be turned on transport and storage pallets through a mechanical manufacturing process.

Keywords: recycling, environmentally friendly, mechanical forming, plastic

1. INTRODUCTION

In 2014 a collect system of plastic caps were created in the student housing of Poitiers, France. With a humanitarian and philanthropic purpose, these caps are sent to a non-profit organization named “Les bouchons d'Amour” which has some partnerships with a company located in Belgium that buy the plastic caps to manufacture transport and storage pallets. “Les bouchons d'Amour” finance equipments for people with disabilities and, occasionally, humanitarian actions in France and abroad.

Worldwide plastic production has been growing during the last years. Recycling one ton of plastic can save 5 774 kWh of energy, about 2 000 gallons of gasoline, 685 gallons of oil, 30 cubic yards of landfill space, 48 000 gallons of water. According to some researches, for more than 50 years, global production of plastic has continued to rise. More than 299 million tons of plastics were produced in 2013, representing a 4 % increase over 2012. Recovery and recycling still remains insufficient and millions of tons of plastics end up in landfills and oceans each year.

An average person living in Western Europe or North America consumes 100 kilograms of plastic each year, mostly in the form of packaging. In Asia this consummation is about 20 kilograms per person, but with a fast growing economy this is expected to grow rapidly as well. About 4 % of the petroleum consumed worldwide each year is used to make plastic, and another 4 % is used to power plastic manufacturing processes. The environmental and social benefits of plastics must be weighed against some problems related to the high durability and volume of this material and having as a direct consequence the waste stream.

Plastics processing techniques depend on the nature of polymers and the destination of the products. Some methods are regularly used in the manufacture of parts and polymer objects. The main industrial manufacturing processes are though injection molding, injection blow molding, extrusion, blow molding, thermoforming, expansion molding, calendering and rotomolding.

2. STEP BY STEP OF RECYCLING

In this section the complete recycling process is detailed. After gathering a good amount of plastic caps (previously selected) they are washed and placed in a large water tank. Advancing into a tray system, the impurities fall to the bottom, the caps float and are cleaned as shown in Fig. (1). This step eliminates the impurities (metal, stone, etc.) that could damage the mill.

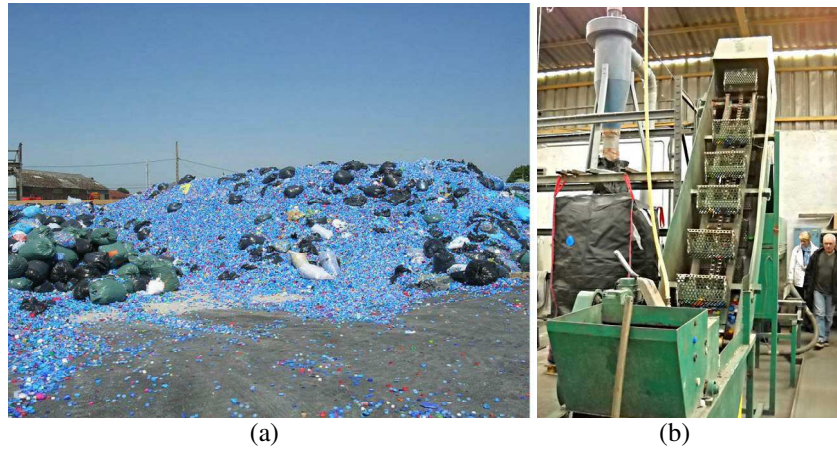


Figure 1: (a) caps stock; (b) washing process (REZENDE JÚNIOR)

After the washing phase, the plastic caps pass through a wringer for water withdrawal. They are then stored in one compartment and aspired into tubes to pass through the mill. These tubes are about 12.5 cm in diameter, which limits the maximum size of the caps, Fig. (2).

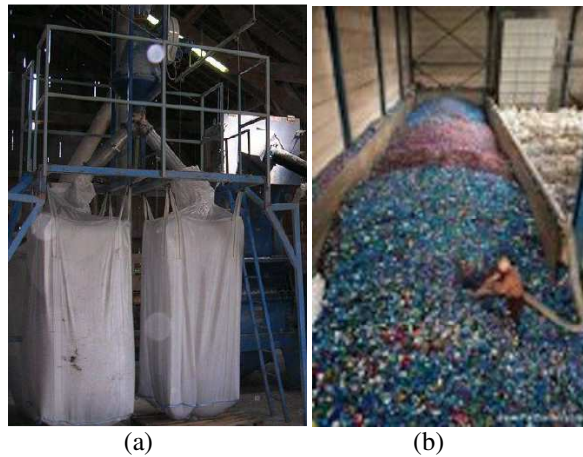


Figure 2: (a) water withdrawal; (b) aspiring phase (REZENDE JÚNIOR)

The next step is the milling, an operation of reducing the caps into small pieces or "chips" with a mechanical crusher, a machine equipped with several blades. This action has as main objective the reduction of the volume of the caps. It is a mechanical step that brings no material refinement. The caps are milled at a rate of 800 kg/h taking the flake form (5 to 10 mm). They are then dusted, Fig. (3).

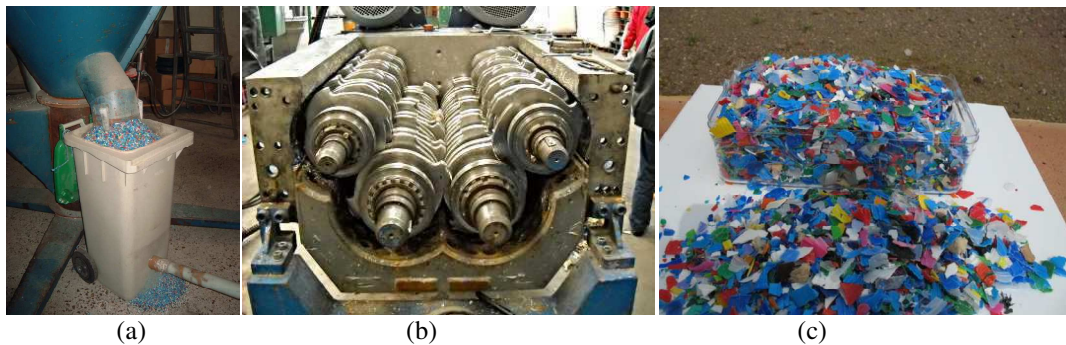


Figure 3: (a) milling step; (b) detail of the milling; (c) flake caps form after milling process (REZENDE JÚNIOR)

After milling phase, the caps pass through the coloring process. Plastic sequins and various ingredients are mixed in a silo according to a receipt, Fig. (4). From this recipe, the final granulate will be produced with some of the necessary characteristics for transport pallets manufacture.



Figure 4: silo mixture (REZENDE JÚNIOR)

Plastic sequins enter then into an extruder adapted with an output granulator. They were previously melted at 280 °C in a paste which passes through a 240 µm filter: the chips pass through a hopper with an endless screw mechanism which pushes them into a tube at 180 °C thanks to heaters bands around it, Fig. (5).



Figure 5: (a) the plastic sequins into the extruder; (b) detail of the heater bands (REZENDE JÚNIOR)

After the cutting step, the past formed leaves the die and is rapidly water cooled to be hardened. The resulting “tablets” are calibrated and pass through a vibrating screen to have a uniform size. They are stored in a tank, Fig. (6).

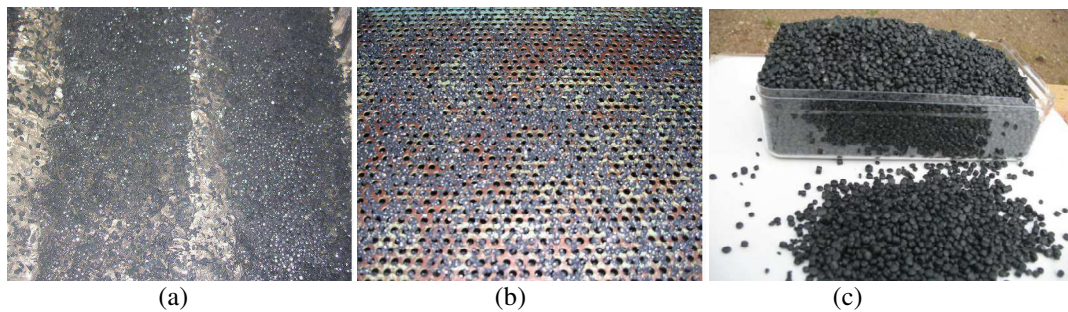


Figure 6: (a) past is water cooled; (b) calibration phase; (c) tablets with a uniform size (REZENDE JÚNIOR)

The resulting tablets are injected into a mold and compressed: the manufacturing transport pallet process is done, Fig. (7).



Figure 7: Final product of the process (ERYPLAST)

3. A NEW IDEA

Since the project works well in France, establish a new concept of plastic recycling in Brazil would be very interesting. This could be started in a local way in the Federal University of Uberlândia, with plastic caps collect sites. It is logically necessary to have partnerships with manufacture pallets companies that buy the plastic material. The raised capital can be used for humanitarian purposes. Brazilian population is about 3.24 times bigger than the French one and this means Brazil is a potential consumer of plastic. Introduce an equivalent system can be successful, the time of collecting plastic caps will be reduced and the people who work with plastic collect will not be harmed as the process is specifically based on plastic caps.

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5. RESPONSIBILITY NOTICE

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