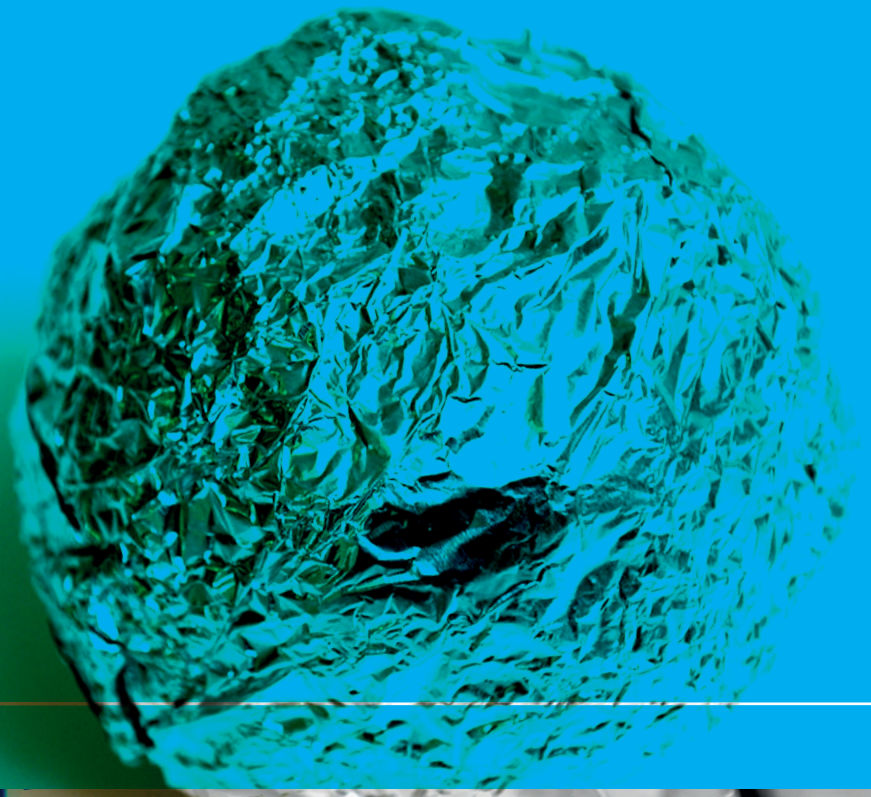
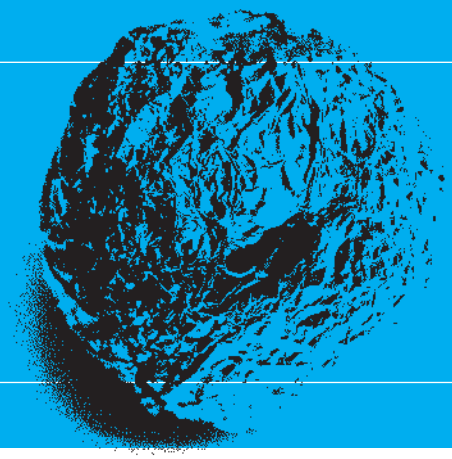
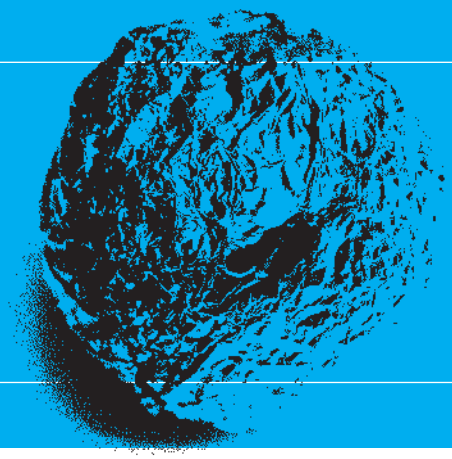
HOW ALUMINIUM PACKAGING PERFORM IN AN EDDY CURRENT SYSTEM





1.- BACKGROUND

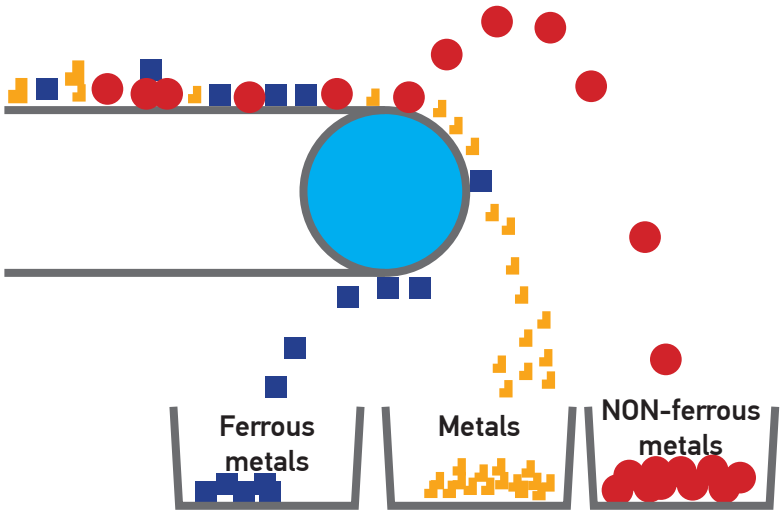
ARPAL and REGULATOR CETRISA have realized several tests in order to find out the behavior of the aluminum packaging in an Eddy Current System. The research has been developed at REGULATOR CETRISA facilities in Gavà (Barcelona) and the main goal was to check in which conditions we can find the best sorting of the aluminum packaging with this technology. The research has been done using different aluminum packaging (semi-rigid and foil) and with different compact conditions.



2.- CONDITIONS AND CRITERIA OF THIS TEST

REGULATOR CETRISA has an important experience in the Eddy current field. Eddy current systems were already applied by REGULATOR CETRISA to obtain regulation and control of the speed and its variation in the electric AC motors before to enter in the metal's separation field. REGULATOR CETRISA manufactures equipment to treatment and sorting metals with a high worldwide prestige and high quality in their products. The great experience acquired in magnetic and inductive fields is very important. A good proof of it is the different inductive rotor developed for different applications. Focusing on aluminium packaging that arrives to Municipal Solid Waste (MSW) and Light Packaging Plants, REGULATOR CETRISA has developed a specific induction rotor that provides a high efficiency in its separation. The test carried out has been done with this induction rotor.

Eddy currents, also called Induction currents, are generated by magnets. The more powerful magnets are, more magnetic field is generated and therefore high power magnets are used (called Neodymium magnets). Some Neodymium magnets in alternative assembly on the rotor means that, with a high speed of rotation, induction currents are generated on a metal. If the metal is a no-ferrous metal, as aluminium packaging, inductive forces are produced to the field that it generates. This opposition of fields provoke that aluminium packaging literally jump forward and then is separated from the natural trajectory of the any other non-metallic material.



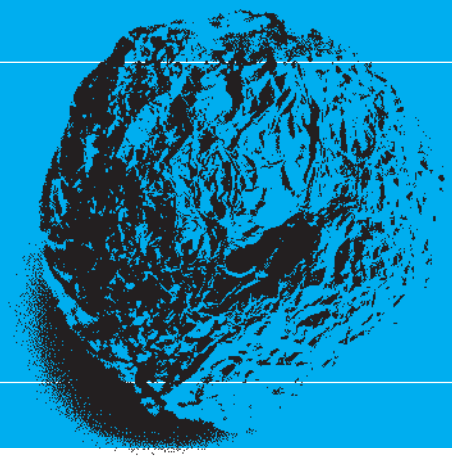
In the attached figure of the R-SPM equipment, the behavior of the different materials can be observed:

NON-ferrous metals: *they suffer a repulsive effect and jump to a certain distance in front of the Foucault Drum.*

Ferrous metals: *They are attracted and are trapped by the Foucault Drum and are separated from it by its lower part and behind the drum's own axis.*

No metals: *They do not suffer influence and follow the trajectory of the natural parabolic fall.*

The test starts with the adjustment of REGULATOR CETRISA Eddy Current Separator with the appropriate induction rotor. First, with the material in the belt of the Eddy Separator, is necessary to adjust it to obtain a good and correct material distribution over the belt. The second step is to adjust the Deflection Plate. The deflection plate must be adjusted to the fall trajectory of the material in order that packaging doesn't go to the other side of the plate. The last step is the start of the induction rotor up to the standard speed. After all these is done the test can begin with the different aluminium packaging.



3.- SAMPLE OF THE RESEARCH

The simple of the research has been the following aluminium packaging (empty and clean):

Item1. Round flat tray of 24 ctm diameter and 12 gr. weight

Item 2. Tall round tray of 21 ctm diameter and 9 gr. weight

Item 3. Rectangular tray 28x13 ctm and 12 gr. weight

Item 4. Rectangular tray 21x16 ctm and 9 gr. weight

Item 5. Rectangular tray 13x15 ctm and 5 gr. weight

Item 6. Square tray 9x9 ctm and 2 gr. weight

Item 7. Flan mold 8 ctm diameter and 2 gr. weight

Item 8. Flan mold 11 ctm diameter and 2.5 gr. weight

Item 9. Chicken tray of 15 gr. weight

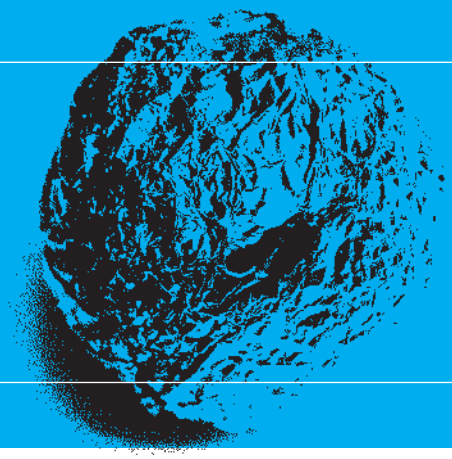
Item 10. Foil ball 8 ctm diameter and 12 gr. weight

Item 11. Foil ball 6 ctm diameter and 8 gr. weight

Item 12. Foil ball 5 ctm diameter and 9 gr. weight

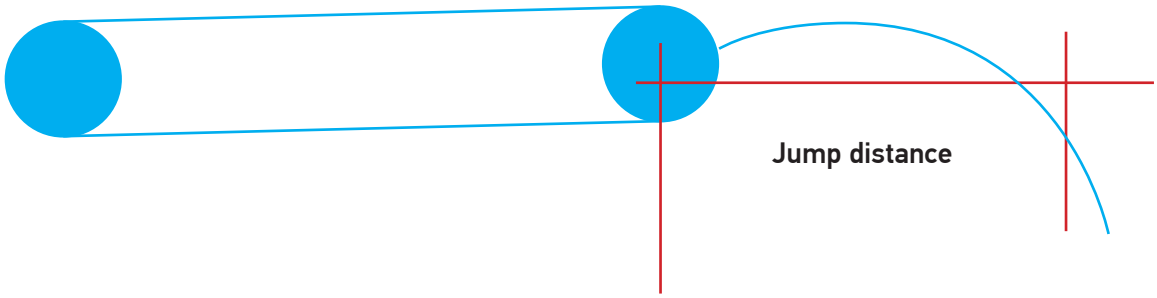
Item 13. Foil ball 4 ctm diameter and 43 gr. weight

Item 14. Foil balls of 4 ctm diameter and 31 and 33 gr. weight



4.- RESULTS

Following we can find the distance than "jump" the different aluminum items considering the distance from the induction rotor shaft. All tests were done without any change, meaning that we didn't move the position of the deflector plate, belt speed or speed of the induction rotor.



ITEM	DESCRIPTION	WEIGHT	DISTANCE
1	Round flat tray Ø 24 cm Round flat tray Ø 24 cm, squashed	12 gr	90 cm 115 cm
2	Tall round tray Ø 21 cm Tall round tray Ø 21 cm, squashed	9 gr	130 cm 120 cm
3	Rectangular tray 28x13 cm Rectangular tray 28x13 cm, squashed	12 gr	110 cm 120 cm
4	Rectangular tray 21x16 cm Rectangular tray 21x16 cm, squashed	9 gr	120 cm 110 cm
5	Rectangular tray 13x15 cm Rectangular tray 13x15 cm, squashed	5 gr	130 cm 90 cm
6	Square tray 9x9 cm Square tray 9x9 cm, squashed	2 gr	90 cm 85 cm
7	Flan mold Ø 8 cm Flan mold Ø 8 cm, squashed	2 gr	95 cm 85 cm
8	Flan mold Ø 11 cm Flan mold Ø 11 cm, squashed	2,5 gr	90 cm 85 cm
9	Chicken tray Chicken tray, squashed	15 gr	130 cm 120 cm
10	Foil ball Ø 8 cm	12 gr	Short jump
11	Foil ball Ø 6 cm	8 gr	Short jump
12	Foil ball Ø 5 cm	9 gr	Short jump
13	Foil ball Ø 4 cm	43 gr	90 cm
14	Foil ball Ø 4 cm	32 gr	85 cm

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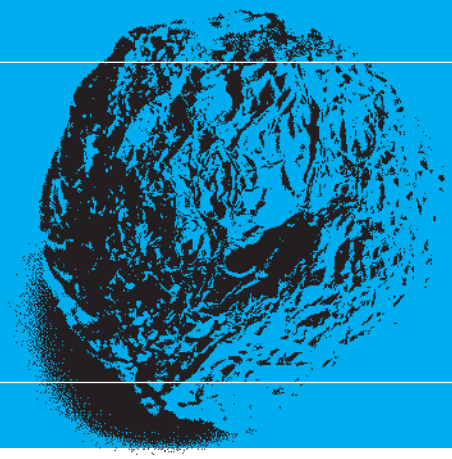
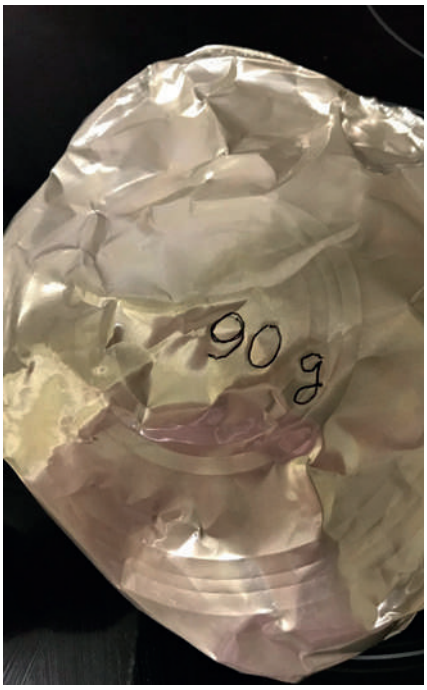
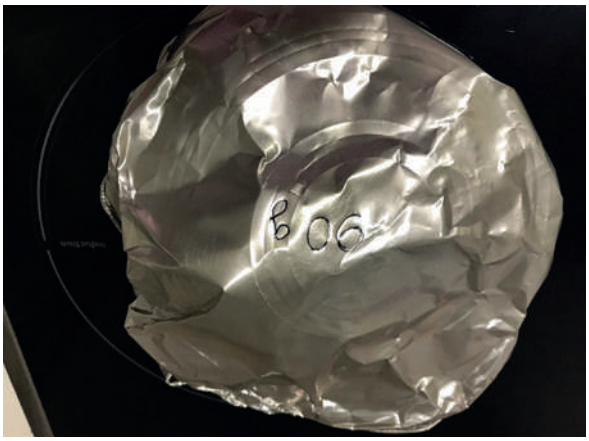
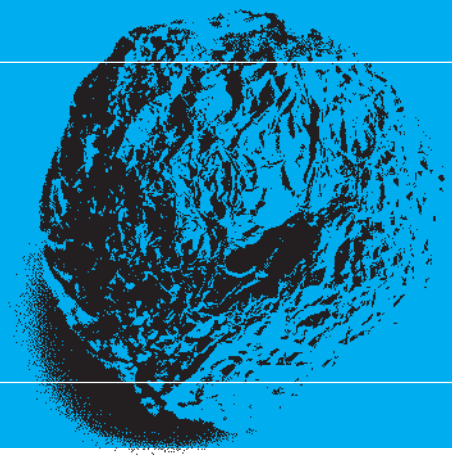


In order to compare with other aluminum packaging that are present in sorting plants we tested also beverage cans and aerosols.

ITEM	DESCRIPTION	WEIGHT	DISTANCE
	Aluminium can	13,6 gr	200 cm
	Aluminium aerosol	38 gr	280 cm







5.- CONCLUSSIONS

The jump values obtained are due to the settings and working position of the Eddy Separator. Any change that was made like varying the speed of the band or the speed of rotation of the rotor, would give us as different values to those we had obtained.

The researchers want to specify that tests were done with three types of aluminum packaging. First, semi-rigid packaging like trays, flan molds, etc. (items 1 to 9). Second with aluminum foil (items 10 to 14). And finally, rigid packaging (cans and aerosols) that, even though they were not part of the research sample, they were needed to establish a comparison.

Semi-rigid packaging

They are enough sorted. It is important the air effect. Packaging with greater surface accuses the brake that provokes on them the air when they are thrown by the induced currents. This effect doen't appear in smaller packaging because they are lighter and are thrown larger distance. More or less all packages are thrown more than 100 cm and or only a very little less. For this reason we can said that all are throw at least 100 cm.

Aluminium Foil

Two important requirements are needed for its separation: compaction and enough mass of aluminum material. The compaction must be sufficient and with enough material, even exceeding the mass of the semi-rigid ones. If these minimum requirements are not met, the jump obtained is short, it doesn't arrive to 50 cm. Aluminum foil behaves like small independent bodies on which weak induction currents are generated. Even the sum of them is not linear and a high result is not obtained to have a significant repulsion of fields and therefore the aluminum jump. Only when there is sufficient mass, even bigger that the one of semi-rigid materials, we get a sufficient repulsion effect needed for the separation. We can therefore determine that the lack of rigidity of the aluminum foil is determinant in its separation.

Cans and aerosols

Here we talk about rigid elements, like cans and aerosols. For both of them the repulsion effect is very high and more important separation is achieved than with the other materials.

The great differences in the distances obtained depending on the packaging allow us to say that the plants that need an effective separation of all the elements should first work according the size of the materials and adjust correctly the Eddy Separators to each size considered. It is clear that the adjustment of the deflector plate cannot be the same when the material is small, such as the 5 cm aluminum foil balls, or when is bigger, like the 24 cm baking trays. Only this parameter can already determine if the separation is correct or not.

6.- LIMITS OF THE RESEARCH

That research has the following restrictions:

- Packaging used was empty and clean. In sorting and waste plants packaging will be mix with food/ liquid, oil, etc. Higher the weigh of the leftovers, less sorting possibilities.

- Conditions of sorting plants, and furthermore from solid waste plants, are different to tests conditions. Packaging arrive to plants with other materials, have different densities, etc. or even filled with other materials. But taking into consideration that the test has verified that all packages jump correctly we can assure that they should be sorted correctly in the plants, especially if the plants have a previous size classification.