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INDUCED ENVIRONMENTAL IMPACT OF COMBINED PLASTIC AND PAPER WASTES BEFORE AND AFTER VALORIZATION

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Introduction

Combined plastic and paper waste (paper envelopes with plastic window, large envelopes made from paper with plastic air bubble, etc.) are not recyclable by current technologies. The only viable alternative to disposal is storage, but in this case a series of problems arise from the release of pollutant compounds into the leachate. It has been studied the possibility of using this non-recyclable waste by including it in the structure of composite materials that have applicability in the field of constructions. Current paper presents the results obtained in the analysis of leachates of combined plastic and paper waste before being included in the matrices of composite materials and after applying this recovery process. The comparative analysis of the results highlights the environmental impact of each category of waste.

Materials and methods

The waste material taken in the study was subjected to the leaching process following the procedure described in SR EN 12457-2: 2003. The leachates obtained were characterized by determining the values of all the indicators stipulated in Order no. 95/12.02.2005 regarding the establishment of acceptance criteria and preliminary procedures for the acceptance of waste for storage and the national list of accepted waste in each waste disposal class. The metal content was determined using an inductively coupled plasma mass spectrometer ICP-MS 7900 Agilent Technologies, (Japan), sulphate and chloride anions values were determined using a DIONEX ICS-3000 ion chromatograph (U.S.A.) with AG23 Dionex column and suppressed conductivity detection. A nitrogen/carbon Analyzer N/C 3100, AnalytikJena, (Germany) was used to determine the dissolved organic carbon (DOC) indicator values.

Results and conclusions

For the experiments, three types of mixed plastic and non-recyclable paper waste and 6 types of materials were included in the study. Sample codes are as follows: P1 - paper envelope with plastic inside; P2 - paper envelope with plastic applied externally; P3 - blend of paper envelopes with plastic window; P4 - polypropylene grinding (PP) with 5% combined plastic and paper waste (CW) ; P5 - high density polyethylene (HDPE) grinder with 5% CW; P6 - composite material obtained by injection of HDPE

and 5% CW; P7 - composite material obtained by injection of HDPE blend and 15% CW; P8 - composite material obtained by injection of PP mixture and 5% CW; P9 - composite material obtained by injection of PP mixture and 15% CW. The table 1 shows the values obtained for 3 of the 18 analyzed indicators, stipulated in Order no. 95 / 12.02.2005.

Table 1. Results

Sample	Indicator		
	DOC (mg/kg DW)	TDS (mg/kg DW)	Zn (mg/kg DW)
P1	4650	15920	0.232
P2	3970	10880	0.259
P3	10020	28080	0.209
P4	2390	8600	57.769
P5	3790	11280	109.211
P6	55.7	80	0.639
P7	70.1	120	0.345
P8	43	200	0.201
P9	135.8	400	0.744

The obtained results highlight the fact that for samples P1 - P3 the only indicator for which the exceedance of the limit values imposed by the legislation in force is the dissolved organic carbon content (DOC). The limit value imposed by Order no. 95 / 12.02.2005 is 800 mg/kg DW for non-hazardous waste landfills and 1000 mg/kg, for hazardous waste landfills. Obtained values exceed imposed limit values by 3.97 to 10.02 times, making impossible to store combined plastic and paper waste, resulting in a negative impact on the environment due to the high content of organic compounds. The problem is maintained in the case of samples P4 and P5 which, in the crushed condition, release large amounts of dissolved organic compounds into the leachate. With the inclusion (by injection) of these wastes in the matrices of composite materials, the effect on the environment is considerably diminished, the values obtained being much lower than the limit value. The situation is similar for the other two indicators mentioned in the table.

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