PRECEPT 4: MBT PLANT DESIGN

130000 tonnes of waste are treated in a MBT plant equipped with 3 identical lines, whose layout is reported in Figure 1. The plant operates 12 hours a day (two work shifts of 6 hours each) and 325 days a year (40 days of stop for maintenance), with the exception of the biological process which operates 24 h a day and 365 days a year. The waste composition is reported in Table 1.

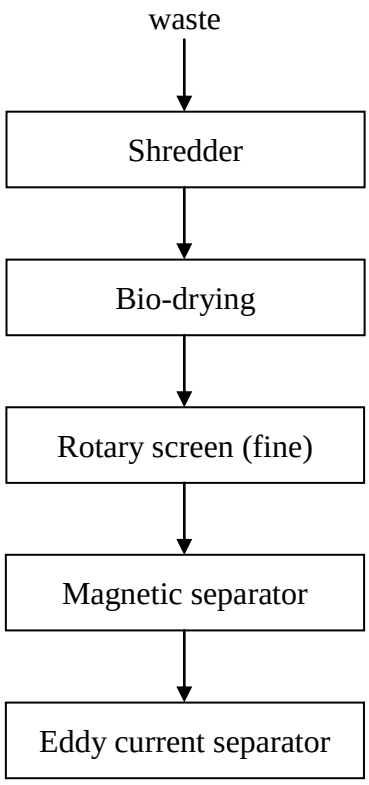

Figure 1: layout of the MBT plant

Table 1: waste composition

Fraction / Parameter	**Ferrous metals**	**Non ferrous metals**	**Glass and inert**	**Paper**	**Plastic**	**Fine fraction**	**Wood**	**Food waste**
Composition (%)	2	1.51	3.53	24.69	19.15	12.09	6.05	30.98
Moisture (%)	5.00	5.00	2.50	14.00	6.00	30.00	22.00	70.00
Ash (%)	92.50	92.50	95.00	5.00	9.00	35.00	1.50	9.00
Volatile solids (%)	2.50	2.50	2.50	81.00	85.00	35.00	76.50	21.00
LHV_{vs} ($kJ/kg_{fr,vs}$)	0	0	0	22406	28893	12279	24146	17229
C (% dry)	1	1	1	43.7	59	29.3	48.2	32

During the bio-drying process, 50% of the volatile organic carbon is biodegraded (i.e. 50% of the organic carbon in the food waste and in the fine fraction). The waste moisture decreases thanks to the energy released by the biodegradation reactions which promote the evaporation process. The water evaporation is proportional to the water content in each waste fraction. About 60% of the

released energy is lost in the environment instead of being used in the drying process. The process kinetic can be considered of first order, with a coefficient k equal to 0.07 d^{-1}.

For the mechanical treatments, the effect of each machine on the waste composition can be evaluated using the RFTF matrix, reported in Table 2.

Table 2: RFTF (recovery factor transfer function) matrix. Numbers represent the fraction that remains in the main stream (d = dry matter, m = moisture).

Fraction / Machine		**Ferrous metals**	**Non ferrous metals**	**Glass and inert**	**Paper**	**Plastic**	**Fine fraction**	**Wood**	**Food waste**
Shredder	d	1	1	1	1	1	1	1	1
	m	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Rotary screen (fine)	d	0.8	0.8	0.2	0.85	0.9	0.25	0.5	0.25
	m	0.8	0.8	0.2	0.85	0.9	0.25	0.5	0.25
Magnetic separator	d	0.2	1	1	0.98	0.98	1	1	0.95
	m	0.2	1	1	0.98	0.98	1	1	0.95
Eddy current separator	d	0.9	0.1	1	0.98	0.98	0.95	0.98	0.98
	m	0.9	0.1	1	0.98	0.98	0.95	0.98	0.98

Additional data:
Heat release from carbon oxidation = - 32650 kJ/kg_c
Evaporation latent heat of water at 55°C = 2400 kJ/kg
Waste density = 0.3 t/m^3

1) Evaluate the mass balance of the MBT plant and the composition and the characteristics of the produced SRF (Solid Recovered Fuel).

2) Design the bio-drying basin