



**Università Politecnica delle Marche**

**CHARACTERIZATION OF EFFLUENTS  
FROM FOOD WASTE DISPOSERS  
INTERCEPTED BY FILTERING APPARATUS  
PRODUCED BY ECOFAST ITALIA S.R.L**

April 2012

Scientific referring

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## Summary

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# 1 Introduction

This document is composed by two sections:

1. The first part is related with the general concepts of discharge of wastewater in sewer system or in surface waters according with the Italian law D.Lgs 152/06 in adoption of European Directives 91/271/CEE for urban wastewater.
2. The second section of this document shows the results obtained as chemical physical characterization made on two samples of effluents from food waste disposers intercepted by filtering apparatus and produced by ECOFAST ITALIA S.r.l. (SAMPLE A and SAMPLE B).

## **2 Wastewater discharge for Italian law**

### ***2.1 General definition***

The general definition of wastewater discharge reported in D.Lgs. 152/06 is “*any release of wastewater into surface water, soil, subsoil and sewer systems, regardless of their polluting nature, also subjected to a previous treatment*”.

This definition is an important concept because define as “discharge” any wastewater released into any receptors independently of the introduction method (by pipe or not).

In the absence of a specific regional legislation, any type of wastewaters discharged from commercial activities is considered as industrial wastewater (also wastewater from restaurants, caterings and canteens). The assimilation of some typologies of industrial wastewaters to domestic ones is defined by specific regional law on the basis of the amount of the discharge and/or of the equipments and the residual capacity of the wastewater treatment plant intended to receive the total flow of the sewer system.

### ***2.2 Discharges typologies***

Related with the more common typologies of discharges, the Italian law determines the following definition:

#### Discharges to public sewer system

The discharge of domestic wastewater is always permitted, provided that the regulation of the managing authority of urban wastewater treatment system (Article 33, paragraph 2).

The industrial wastewater can be discharged according with the technical standards, the emission limit values and any regulatory requirements issued by the managing and the controlling authorities (Article 33, paragraph 1).

#### Discharges into surface waters

The discharges of industrial wastewater are permitted after appropriate authorization according with the emission limit values (Article 31, paragraph 1).

The discharges of urban wastewater, depending on the specific conditions, must be subjected to appropriate treatments. They must, however, respect the emission limit values (Article 31, paragraphs 2, 3 and 4).

### Discharges into surface waters in sensitive areas

Considering the emission limit values of the previous definition, the discharge of urban wastewaters into surface water located in sensitive areas (areas that require particularly stringent measures because they have been exposed - or the risk of being in the future – to serious pollution phenomena) is subject to more advanced treatment than that provided for the same waters discharging to surface waters (Article 31, paragraph 3).

### **2.3 Authorization procedures**

All the discharges must be previously authorized (Article 45, Paragraph 1), with the exception of the discharge of domestic wastewater and those compared in the sewage systems (Article 45, paragraph 4) that are always allowed according with regulation of managing authority.

### **2.4 Control procedures**

The competent authority must adopt a program “*to ensure a regular, common, effective and impartial system tests*” (Article 49, paragraph 1) also as number of samples in the years and analytical methods.

In terms of general sampling methodology is provided:

- For the discharges of industrial wastewater, average samples in 3 hours;
- For the discharges of urban wastewaters from treatment plants, are taken into account the average samples in 24 hours.

The Italian law provides that the sampling point to control the concentrations limits must always be the same and must be placed immediately upstream of the point where the effluent flow enters into the receiving system (water surface or sewer system). The flow sampled must be total one injected in the receiving system. The sampling phase is usually conducted by an auto-sampler, equipped with a peristaltic pump that collects different quotes of the effluent to create a representative sample of the total discharge on the basis of 3 hours for the industrial wastewater and on the basis of 24 hours for the urban wastewater. The number of the control samples in one year changes on the basis of the type of the wastewater (industrial or urban), final discharge point (sewer system or surface waters), wastewater treatment plants capacity and specific authorization definitions.

### 3 Chemical Physical Characterization of SAMPLE A and SAMPLE B

The samples characterized coming from the food waste disposers are specifically defined as reported:

Sample A: Wastewater from discharging pipe on Ecofast Dehydrating machine with filtering apparatus consisting by a drilled cylinder made of AISI 304 with holes of 1.5 mm and patch of 3 mm;

Sample B: Wastewater from discharging pipe on Ecofast FS3, OPRCC unit filtered through special filter in woven polypropylene monofilament with openings of 300  $\mu\text{m}$ .

The percentages composition of Organic Fraction of Municipal Solid Waste disposed is the following and represents an example of typical composition of domestic OFMSW:

- ✓ 26% of Fruit;
- ✓ 31% of Bread & Pasta;
- ✓ 37% of Vegetables;
- ✓ 6% of Fish.

The chemical and physical characterization in terms of main macropollutants, anions and cations concentrations of the SAMPLE A and B was made according with the Standard Method (APHA, 2010). The results obtained are reported in Table 1.

**Table 1 Characterization of SAMPLE A and B**

|                        |                                | SAMPLE A | SAMPLE B |
|------------------------|--------------------------------|----------|----------|
| pH                     |                                | 6.5      | 6.45     |
| Alkalinity             | $\text{mgCaCO}_3\text{L}^{-1}$ | 203      | 180      |
| COD                    | $\text{mgL}^{-1}$              | 23300    | 12380    |
| TSS                    | $\text{mgL}^{-1}$              | 454      | 357      |
| $\text{NH}_4\text{-N}$ | $\text{mgL}^{-1}$              | 16.8     | 20.9     |
| TKN                    | $\text{mgL}^{-1}$              | 36.4     | 21.7     |
| $\text{NO}_2\text{-N}$ | $\text{mgL}^{-1}$              | 0.3      | 2.5      |
| $\text{NO}_3\text{-N}$ | $\text{mgL}^{-1}$              | 0.0      | 0.1      |
| TN                     | $\text{mgL}^{-1}$              | 36.7     | 24.2     |
| $\text{Na}^+$          | $\text{mgL}^{-1}$              | 102      | 100      |
| $\text{K}^+$           | $\text{mgL}^{-1}$              | 100      | 98       |
| $\text{Mg}^{++}$       | $\text{mgL}^{-1}$              | 22       | 20       |
| $\text{Ca}^{++}$       | $\text{mgL}^{-1}$              | 80       | 76       |
| $\text{Cl}^-$          | $\text{mgL}^{-1}$              | 172      | 175      |
| P-PO4                  | $\text{mgL}^{-1}$              | 5.2      | 6.9      |
| $\text{SO}_4^-$        | $\text{mgL}^{-1}$              | 19.5     | 17.4     |

As showed in the Table 1 the SAMPLE A and B are characterized by contained concentrations of TSS ( 454 mgL<sup>-1</sup> and 357 mgL<sup>-1</sup> respectively for SAMPLE A and B) and low amounts of nutrients (N and P) expressed as ammonia (16.8 mgL<sup>-1</sup> and 20.9 mgL<sup>-1</sup> respectively for SAMPLE A and B), as total nitrogen (36.7 mgL<sup>-1</sup> and 24.2 mgL<sup>-1</sup> respectively for SAMPLE A and B) and as orthophosphates (5.2 mgL<sup>-1</sup> and 6.9 mgL<sup>-1</sup> respectively for SAMPLE A and B). The pH conditions are similar for the two samples analysed and almost neutral. The other anions and cations are present in not elevated concentrations also for the chloride (172 mgL<sup>-1</sup> and 175 mgL<sup>-1</sup> respectively for SAMPLE A and B). Finally, the COD is defined equal to 23300 mgL<sup>-1</sup> for SAMPLE A and to 12380 mgL<sup>-1</sup> for SAMPLE B. It is important define that, as reported in the scientific literature (Bolzonella et al., 2003; Marashlian et al., 2005; Galil et al., 2001; Battistoni et al., 2007), that the COD from the OFMSW (Organic Fraction of Municipal Solid Waste) is mainly composed by soluble COD. This condition determines that the discharge flow containing amount of food waste disposed increase the rapidly biodegradable fraction (RBCOD) in the sewer system. Further, this extra-load of organic material, influent in a wastewater treatment plant, can improve the performances of the activated sludge processes. In this way, two batch tests of Nitrate Uptake Rate were made using activated sludge of a real urban wastewater treatment plant (WWTP) in 0.6 l of volume. Nitrates were added as KNO<sub>3</sub> solution. SAMPLE A (Test 1) and SAMPLE B (Test 2) were used as carbon sources. The final results of denitrification rates (kd: kgNO<sub>x</sub>-N<sub>reduced</sub>/kgVSSd), reported at standard temperature of 20 °C, were compared with that obtained, with the same procedure, but using sodium acetate as carbon source (Test 3). The sodium acetate is one of the most common reagents utilized as pure rapidly biodegradable carbon source and the data obtained represents the maximum kd. The results are summarized in Table 2.

**Table 2 NUR Test**

| TEST | Sludge                          | Nitrates         | Batch Test Volume | Carbon Source | Kd at 20°C                  |
|------|---------------------------------|------------------|-------------------|---------------|-----------------------------|
|      |                                 |                  | l                 |               | kgNO <sub>x</sub> -N/kgVSSd |
| 1    | Activated sludge from real WWTP | KNO <sub>3</sub> | 0.6               | SAMPLE A      | 0.162                       |
| 2    |                                 |                  |                   | SAMPLE B      | 0.192                       |
| 3    |                                 |                  |                   | ACETATE       | 0.180                       |

The kd at 20 °C using the SAMPLE A and SAMPLE B as carbon sources defined values respectively equal to 0.162 and 0.192 kgNO<sub>x</sub>-N/kgVSSd. The data achieved with acetate determined a denitrification rate of 0.180 kgNO<sub>x</sub>-N/kgVSSd, usual value for maximum kd in the activated sludge of urban WWTP. Therefore, the denitrification rates with SAMPLE

A and B result, as values, comparable with that obtained with acetate. This condition defines that the effluent flow from food waste disposed is composed, mainly, of RBCOD and could determine an important increase of real WWTP performances as nitrogen removal, in the denitrification phase of the main biological reactor of the urban WWTP, and as biogas production in the anaerobic digestion process (when present).



## 4 References

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