LIFE Project Number

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DELIVERABLE D.C.1.1: SOCIOECONOMIC IMPACT REPORT.

ADNATUR: Demonstration of natural coagulant use advantages in physical & chemical treatments in industry and urban wastewater.

CONTENTS

1. INTRODUCTION

This Deliverable include the socio-economic impact comparing the initial situation with the improved one in order to confirm the adequacy of the demonstrator and the progress achieves. It is aimed that the new system validated increase advantages and savings in comparison with the previous ones.

The socio-economic impact is based on comparative study with all obtained results in previous exposed stages of the project, mainly action B.2, and current procedures to treat industrial (textile and ceramic), and urban wastewaters.

It has been identified and quantified the socio-economic advantages and savings of the demonstrated technology. Not only the costs per cubic meter of the treatment come into play but also the reduction of taxes due to the pollution load of discharge, quality of the sludge being handled and the service life and maintenance of the facilities, as a result of the use of oxidizing and / or corrosive products.

2. MONITORING OF SOCIOECONOMIC INPACT IN TEXTILE COMPANY–TEXTILS MORA

During first stage of the action it was compiled and studied the historical data relate to:

- Chemical products consumption in WWTP
- Contamination values (COD, TSS, Conductivity…), which are collect in the report of environmental impact; D.C.1.2,

Table 1 collets chemical products consumption in TEXTILS MORA during 2013:

Chemical product	Annual consumption (Kg)
Aluminum Polychloride coagulant (18% dilution)	**4.000**
Flocculant DERYPOL ASS 140	**50**
Caustic Soda (25% dilution)	4.000
Flocculant DERYPOL DR4000 (centrifugue)	1.440
Treating 22.000 m^3/year	

Table 1. *Chemical products consumption in textile WWTP (2013).*

However, the consumption of these products during 2014 and 2015 increases because of the treated volume and organic contamination augment, that is reflected in inlet COD's values. These consumption values are collected in table 2:

Chemical product	Annual consumption (Kg)
Aluminum Polychloride coagulant (18% dilution)	**16.500**
Flocculant DERYPOL ASS 140	**200**
Caustic Soda (25% dilution)	12.000
Flocculant DERYPOL DR4000 (centrifugue)	4.000
Treating 30.000 m^3/year	

Table 2. *Chemical products consumption in textile WWTP (2014&2015).*

After trials in textile company during demonstration action, the chemical dosages in prototype and in real installation are collected in table 3:

MONTH	DOSAGE of Aluminum polyclhoride (ppm)	DOSAGE of ADNATUR coagulant (ppm)	REDUCTION of coagulant consumption (%)
March	550	400	27,3
April	550	350	36,4
May	550	350	36,4
June	550	350	36,4
July	550	200	63,6
September	550	200	63,6
October	**550**	**200**	63,6

Table 3. *Chemical products consumption during demonstration phase.*

It is necessary to notice that the flocculant consumption is not collected because it is the same in both cases. This variable do not change.

From these values are calculated the costs and savings per m^3, associated with the consumption of coagulant, which are collected in table 4:

PRIZE of Aluminium polyclhoride	PRIZE of ADNATUR coagulant
0,18 €/m³ wastewater	**0,18 €/m³ wastewater**
5.445 €/year	**5.400 €/year**
Given by:	Given by:
✓ 0,33 €/Kg	✓ 0,90 €/Kg
✓ 550 ppm (mg/L)	✓ 200 ppm (mg/L)
✓ **16.500 Kg/year**	✓ **6.000 Kg/year**
Treating 30.000 m³/year	

Table 4. *Data related to cost calculation to treat a m³ of wastewater in the tertiary treatment of textile company.*

After demonstration action B2 in textile company, it is concluded that the prize of both products; Aluminium polychloride and ADNATUR coagulant for each treated wastewater m³, are almost the same because the ADNATUR coagulant dosage has been much optimized. However, it is important to mention those savings, which comes from the reduction of taxes directly linked with the reduction of the contamination.

The prize is the same although with ADNATUR coagulants it is important to consider the TAX DEDUCTION applied for water contamination.

"CANON de SANEAMIENTO", (Cs) is the Spanish Tax associated to the contamination wastewater, when they are poured to the urban WWTP and it is calculate according to the following formulation:

$$Cs = (Qs + Qc \times V) \times Cc$$

Where:

- Qs: suplying total water cost (€/year)
- Qc: cost of water (€/m³)
- V: consumption flow (m³/year)
- Cc: Correction coefficient, which is calcualte according following formulation

$$Cc = ICV \times IP \times (ICC + ICE)$$

Where:

- ICV: volumen index
- Rest of parameters are related diectly with the contamination

The value of corrector coefficient can be between 0,1 to 10 and this implies important amount of money. In TEXTILS MORA case, it has implied saves at least of nearly 5.000€/year depending on the exactly volume poured, see table 5.

Resolution Date	Corection coeficient	Volume (m³)	€/year	Differences (€)
09/12/2010	**0,27**	**22.000**	**4.032,00**	**---**
01/01/2013	**0,99**	**30.000**	**14.344,00**	**+10.312,00**
27/04/2015	**0,26**	**30.000**	**3.992,00**	**-10.352,00**
24/09/2015	**0,57**	**30.000**	**8.920,00**	**+4.928,00**

Table 5. *Correction coefficient, depending the poured pollution in treated wastewater and the associated payed taxes to it.*

All these economic advantages and saves have let TEXTILS MORA to change the current coagulant, Aluminum Polychloride, by ADNATUR coagulant in their textile WWTP. Part the obtained results are collected in the report of the environmental impact, D.C.1.2.

3. MONITORING OF SOCIOECONOMIC INPACT IN URBAN WWTP –EGEVASA

During first stage of the action it was compiled and studied the historical data relate to:

- Chemical products consumption in unban WWTP in Ontinyent
- Contamination values (COD, TSS, Conductivity, NH4, TP…), which are collect in the report of environmental impact; D.C.1.2,

Table 6 collets Ferric chloride consumption to remove the phosphorous in urban WWTP in Ontinyent, during 2014:

2014	Ferric Chloride (ppm)	Treated Volume(m^3/day)
January	17,5	14.774
February	15,5	16.461
March	14,5	16.511
April	20,1	17.801
May	20,0	19.962
June	13,5	18.545
July	16,0	16.639
August	18,0	14.190
September	22,0	14.243
October	36,5	14.456
November	24,0	14.395
December	24,5	13.492
Average	**20,0**	**15.956**
Annual consumption (Kg)	**116.480,0**	
Annual treated volume (m^3)	**5.824.000**	

Table 6. *Ferric chloride consumption in urban WWTP in Ontineynt (2014).*

However, the consumption of ferric chloride increases during 2015 and 2016 because of the augment of phosphorous concentration in treated wastewater (from 4ppm to 6ppm of annual average). These consumption values are collected in table 7:

2015	Ferric Chloride (ppm)	Treated Volume(m^3/day)
January	107,00	10.590
February	102,00	11.523
March	83,99	13.831
April	94,00	11.097
May	92,00	11.965
June	94,00	11.726
July	100,01	12.414
August	118,00	8.875
September	109,00	11.241
October	117,01	10.937
November	120,00	10.883
December	121,99	10.345
2016	**Ferric Chloride (ppm)**	**Treated Volume(m^3/day)**
January	118,00	9.968
February	101,00	9.933
March	104,01	11.937
April	96,00	11.568
May	97,00	11.284
June	98,00	11.650
July	106,00	11.872
Average	**104,4**	**11.183**
Annual consumption (Kg)	**420.000**	
Annual treated volume (m^3)	**4.000.000**	

Table 7. *Ferric chloride consumption in urban WWTP in Ontineynt (2015 and 2016).*

If the values of tables 6 and 7 are compared, it is very interesting to notice that volume of wastewater treated has decreased 30% but the coagulant consumption has increased nearly 4 times more.

After trials in urban WWTP in Ontinyent, the chemical dosages in prototype and in real installation are collected in table 8:

MONTH	DOSAGE of Ferric Chloride (ppm)	DOSAGE of ADNATUR coagulant (ppm)	REDUCTION of coagulant consumption (%)
May	92,00	118,00	-28,2
June	94,00	104,40	-15,5
July	100,01	102,20	-2,2
August	118,00	107,64	8,8
September	109,00	118,00	-8,2
October	117,01	117,13	0,0
November	120,00	114,70	4,4
December	121,99	117,59	3,6
January	118,00	112,50	4,7
February	101,00	118,00	-16,8
March	104,01	109,95	-5,7
April	96,00	53,36	46,64
May	97,00	52,66	46,26
June	98,00	52,78	46,14

Table 8. *Chemical products consumption during demonstration phase.*

From all these values are calculated the costs and savings per m^3, associated with the consumption of coagulant, to remove the nutrients as phosphorous. They are collected in table 9:

PRIZE of Ferric clhoride	PRIZE of ADNATUR coagulant
0,03 €/m^3 wastewater	**0,05 €/m^3**
105.612 €/year	**193.575 €/year**
Given by:	Given by:
✓ 0,25 €/Kg	✓ 0,90 €/Kg
✓ 104 ppm (mg/L)	✓ 53 ppm (mg/L)
✓ **420.000 Kg/year**	✓ **193.200 Kg/year**
Treating 4.062.000 m^3/year	

Table 9. *Data related to cost calculation to treat a m^3 of wastewater in urban WWTP to remove phosphorous.*

In urban WWTP in Ontinyent trials, the prize of Ferric chloride for each treated wastewater m^3 is 0,02 € cheaper than ADNATUR coagulant for each treated wastewater m3, which implies 88.145 €/year less but it is necessary to consider the quality of the sludges. Spain sludges can contain iron. The quantity of iron is not restricted by the Law, (REAL DECRETO 1310/1990, DE 29 DE OCTUBRE, por el que se regula la utilización de los lodos de depuración en el sector agrario), when sludges are used to fertilize the fields. However, there are European countries as Germany, where the iron is forbidden in sludges so their management are more expensive because they are consider harmful. Environmentally, it important to notice that using ADNATUR coagulant, 226.800 Kg/year of Ferric chloride would stop being consumed.

On the other hand, EGEVASA manages a lot of WWTP in the Comunidad Valenciana and most of them use to consume ferric chloride in treatments. However, they suffer many problems of corrosive processes in the facilities. This is the case of WWTP of Benichembla where the flow

jets of the biological reactor are substituted every year by new ones because of the corrosive processes associate to ferric chloride use. Extrapolating the obtained results in the project to WWTP of Benichembla, whose ferric chloride annual consumption is of 540 Kg/year it will predicted that the substitution of ferric chloride by ADNATUR coagulant will imply saves of nearly 90%, as it can see in following table.

PRIZE of Ferric clhoride	PRIZE of ADNATUR coagulant
0,01 €/m^3	0,03 €/m^3
100 €/year	270 €/year
EXPENSES OF CORROVIVE PROBLEMS	
3.000 €/year	0,0 €/year
TOTAL PRIZE m^3	
0.32 €/m^3	**0,03 €/m^3**
Treating 9.600 m^3/year	

Table 10. *Data related to cost calculation to treat a m^3 of wastewater in urban WWTP to remove phosphorous and costs associate to expenses of corrosive problems.*

4. MONITORING OF SOCIOECONOMIC INPACT IN CERAMIC COMPANY –KERABEN

KERABEN WWTP dosages ECOMIX PX in current facilities. This coagulant is a synthetic organic coagulant to remove solids in primary treatment. The obtained results using ECOMIX PX coagulant have been compared to the obtained results in prototype using ADNATUR-v2 coagulant.

During first stage of the action it was compiled and studied the historical data relate to:

- Chemical products consumption in WWTP
- Contamination values (TSS, Conductivity, Turbidity…), which are collect in the report of environmental impact; D.C.1.2,

Table 11 collets chemical products consumption in KERABEN during in 2013 to 2015:

Chemical product	Annual consumption (Kg)	
ECOMIX PX	2013	16.900
	2014	12.200
	2015	14.300
	Average	**14.100**
Treating 120.000 m^3/year		

Table 11. *Chemical products consumption in ceramic WWTP (2013-2015).*

It is important to notice that they do not need chemical products to adjust the pH with this coagulant neither, and to remark that the coagulant consumption has been so regular in last three years.

After trials in ceramic WWTP, the chemical dosages in prototype and in real installation are collected in table 12:

MONTH	DOSAGE ECOMIX PX (ppm)	DOSAGE of ADNATUR coagulant (ppm)	REDUCTION of coagulant consumption (%)
March	120	100	16,7
April	120	100	16,7
May	120	100	16,7
June	120	85	29,2
July	120	85	29,2
September	120	85	29,2

Table 12. *Chemical products consumption during demonstration phase.*

From all these values are calculated the costs and savings per m^3, associated with the consumption of coagulant in physic-chemical treatment. Following table collects the most important dates related to cost calculation to treated ceramic wastewater m^3 to remove the TSS not increasing the conductivity:

PRIZE of ECOMIX PX	PRIZE of ADNATUR coagulant
0,062 €/m^3	**0,059 €/m3**
7.400 €/year	**7.140 €/year**
Given by:	Given by:
✓ 0,515 €/Kg	✓ 0,70 €/Kg
✓ 120 ppm (mg/L)	✓ 85 ppm (mg/L)
✓ **14.100 Kg/year**	✓ **10.200 Kg/year**
Treating 120.000 m^3/year	

In KERABEN trials, the prize of ECOMIX PX for each treated wastewater m^3 is cheaper than ADNATUR-v2 coagulant for each treated wastewater m^3, but the dosage of this last one is lower, that implies 260 €/year of saves using ADNATUR-v2 coagulant and 3.900 Kg/year coagulant would stop being consumed.

Nowadays KERABEN is using ADANTUR coagulant in the industrial facilities in order to optimize the dosage in real condition and change definitively ECOMIX PX by ADNATUR coagulant.

5. SUMMARY CONCLUSIONS

The monitoring phase has allowed comparing throughout the project the results obtained with the prototypes with those usually obtained in the facilities of the end users, in order to know economic issues. They are related to the **costs per cubic meter** of the treatment come into play but also, the **reduction of taxes** due to the pollution load of discharge, **quality of the sludge** being handled and the **service life and maintenance** of the facilities, as a result of the use of oxidizing and / or corrosive products.

- Although in the best of cases, the costs per m^3 using ADANTUR coagulant are the same than the current ones, it is important to consider savings associated with **taxes reduction**, **sludge management** and **maintenance of facilities** between 30 and 50%:
    - TAX DEDUCTION applied for water contamination: in TEXTILS MORA case, it has implied saves at least of nearly 5.000€/year depending on the exactly volume poured.
    - The improvements in the sludge dewaterability imply saves in costs of transport to the waste manager.
    - Saves of nearly 90% avoiding substitution and maintenance of the facilities because of corrosive phenomes.
- Reduction of the use of ADNATUR coagulant compared to inorganic coagulant between 40 and 50% for all treated waters, both industrial and urban.