Prime evidenze analitiche su prove condotte su residui di frantumazione degli autoveicoli

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INTRODUCTION – BACKGROUND DEFINITION

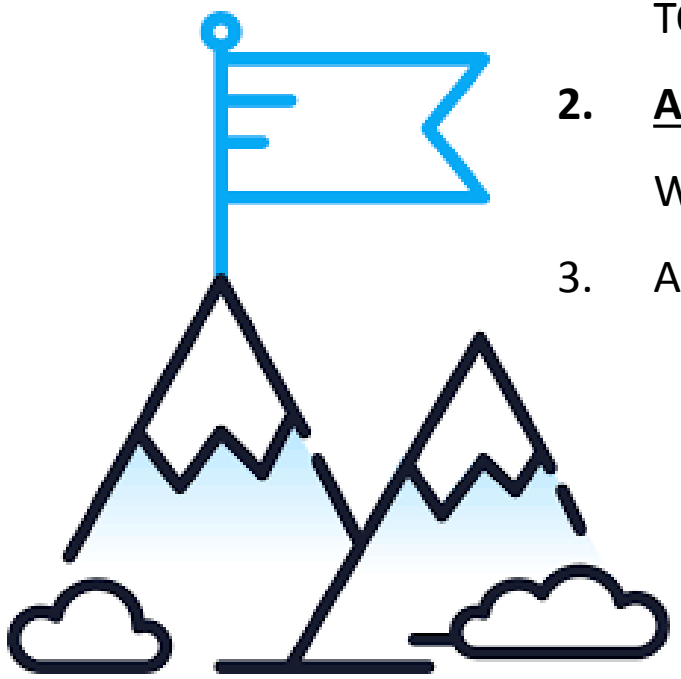
EU Action Plan promotes measures to stimulate Europe's transition towards a circular economy, covering the whole material cycle:

- Sustainable production (promoting the cascade use of by-products)
- **Correct management of residual waste (e.g. HP14 classification)**

POSSIBLE RELEVANT OBSTACLES HINDERING CIRCULARITY

1. Absence of established **End of Waste criteria** for specific type of waste material;
2. Complex Interpretation and Application of **EU Waste Regulation**;
3. **Lab testing requirements not suitable** for the specific material flow

INTRODUCTION – STUDY OBJECTIVES



1. **COMPARE** RESULTS DERIVED FROM THE APPLICATION OF **2 DIFFERENT TESTING PROTOCOLS** TO **OBTAIN WATER EXTRACTS** TO BE TESTED IN ECOTOXICOLOGICAL BIOASSAYS
2. **ASSESS THE CONSISTENCY WITH LANDFILL ACCEPTANCE CRITERIA** for NON HAZARDOUS WASTE (DM 27/09/10 Table 5)
3. ASSESS THE CONSISTENCY WITH ESTABLISHED ECOTOXICOLOGICAL REQUIREMENTS

EN 14735
Preparation of waste samples for ecotoxicity tests
as proposed by Ministry for Solidary and Ecological Transition, France

GHS ANNEX 10
Guidance on Transformation/Dissolution of Metals and Metal compound in aqueous media
as proposed by ISPRA according to
Regulation 1272/2008/EC (CLP) and 440/2008/EC

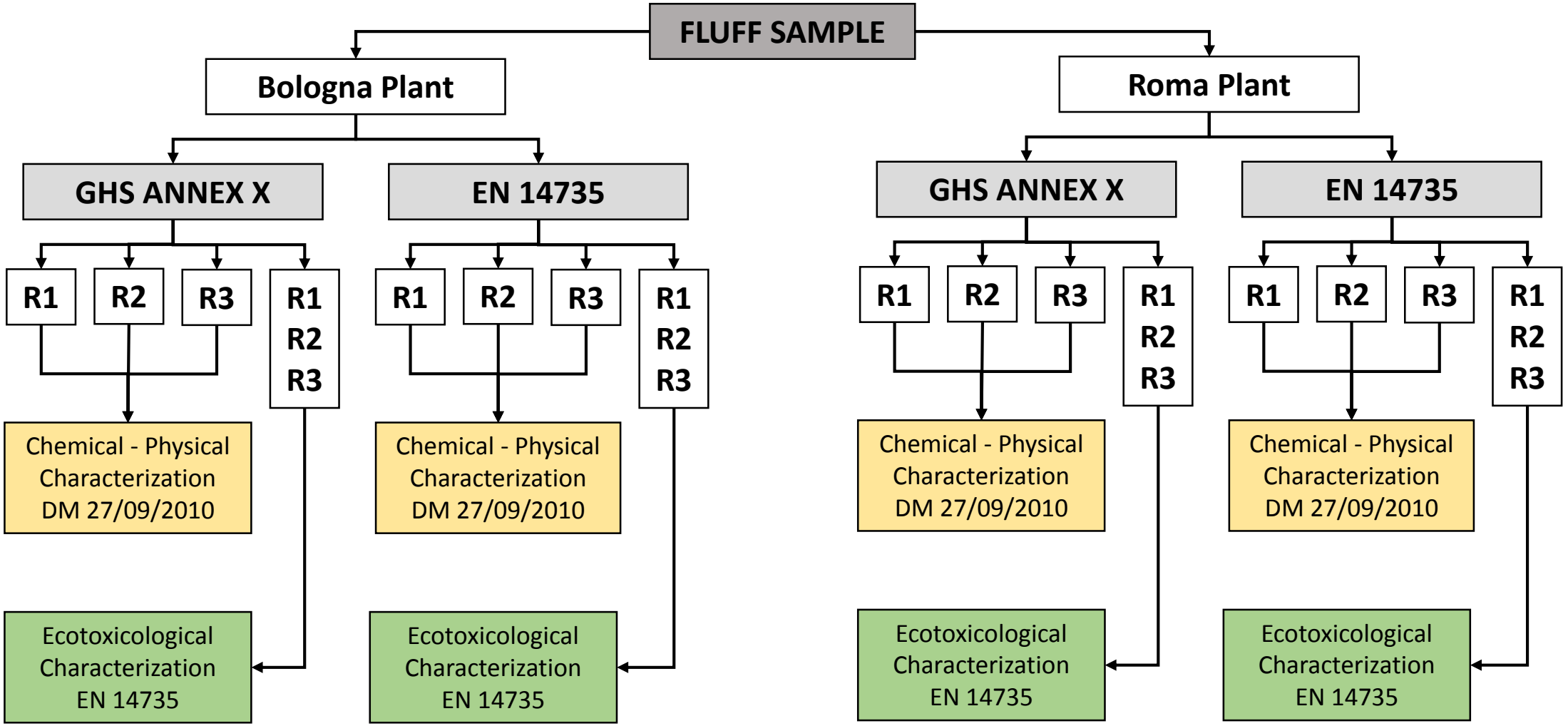
MATERIALS and METHODS – EXPERIMENTAL PROCEDURE

SAMPLING

I) LEACHING TEST

II) CHEMICAL-PHYSICAL ANALYSIS

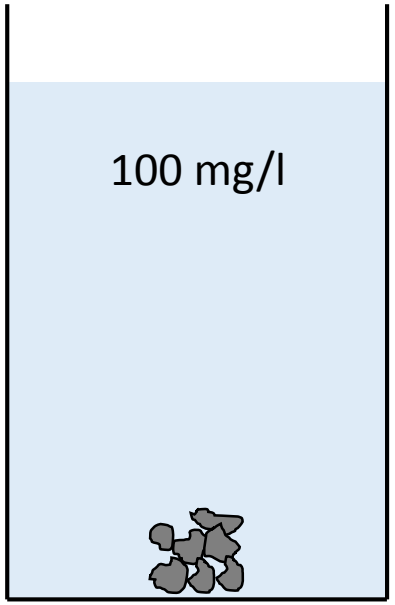
III) ECOTOX ANALYSIS



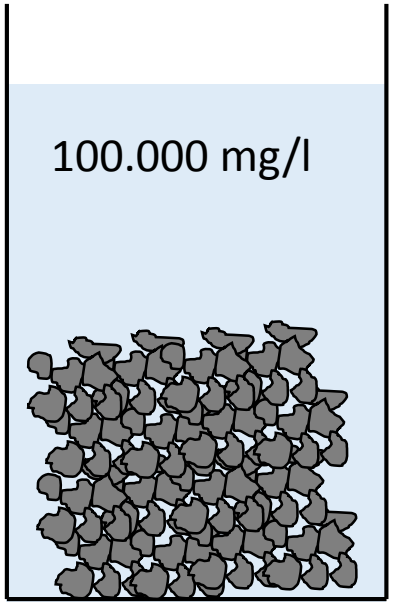
MATERIALS and METHODS
REPRESENTATIVENESS

Representativeness is addressed through the sampling design. Representativeness may be considered as the measure of the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition [ANSI/ASQC, 1994].

GHS ANNEX X



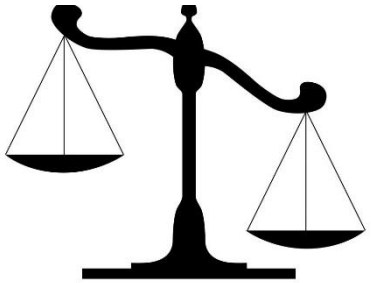
EN 14735



MATERIALS and METHODS

TEST FEATURES INFLUENCE ON CHEMICALS RELEASE IN THE WATER PHASE

	GHS ANNEX X	EN 14735
Particle size reduction	✓	
Test duration	✓	
Liquid-to-Solid Ratio		✓
Test medium	✓	



RESEARCH QUESTION

Which Testing protocols will result to be the

most conservative to determine the potential release of chemicals in the water phase?

MATERIALS and METHODS – CHEMICAL-PHYSICAL ANALYSIS

Parameter	Limits DM 27/09/10 Tabella 5
EC µS/cm	-
TDS mg/l	10000
pH mg/l	-
Sb mg/l	0,07
As mg/l	0,2
Ba mg/l	10
Cd mg/l	0,1
Cr TOT mg/l	1
Hg mg/l	0,02

Parameter	Limits DM 27/09/10 Tabella 5
Mo mg/l	1
Ni mg/l	1
Pb mg/l	1
Cu mg/l	5
Se mg/l	0,05
Zn mg/l	5
DOC mg/l	100
Chlorides (as Cl^-) mg/l	2500
Fluorides (as Fl-) mg/l	15
Sulphates (as SO_4^{2-}) mg/l	5000

Landfill Acceptance criteria used just as reference!

Landfill acceptance criteria cannot replace waste hazardousness classification !

MATERIALS and METHODS – ECOTOXICOLOGICAL BIOASSAYS

1272/2008/EC (CLP)		
Organism	**Standard**	**Limit**
Fish	OCSE/OECD	EC50≤100 mg/l
Crustaceans (Daphnia)	OECD TG 202/C2	EC50≤100 mg/l
Algae	OECD TG 201	EC50≤100 mg/l

- Designed for products
- Fish test difficult to implement
- Scientific community approves EN 14735 for HP14 of WASTE

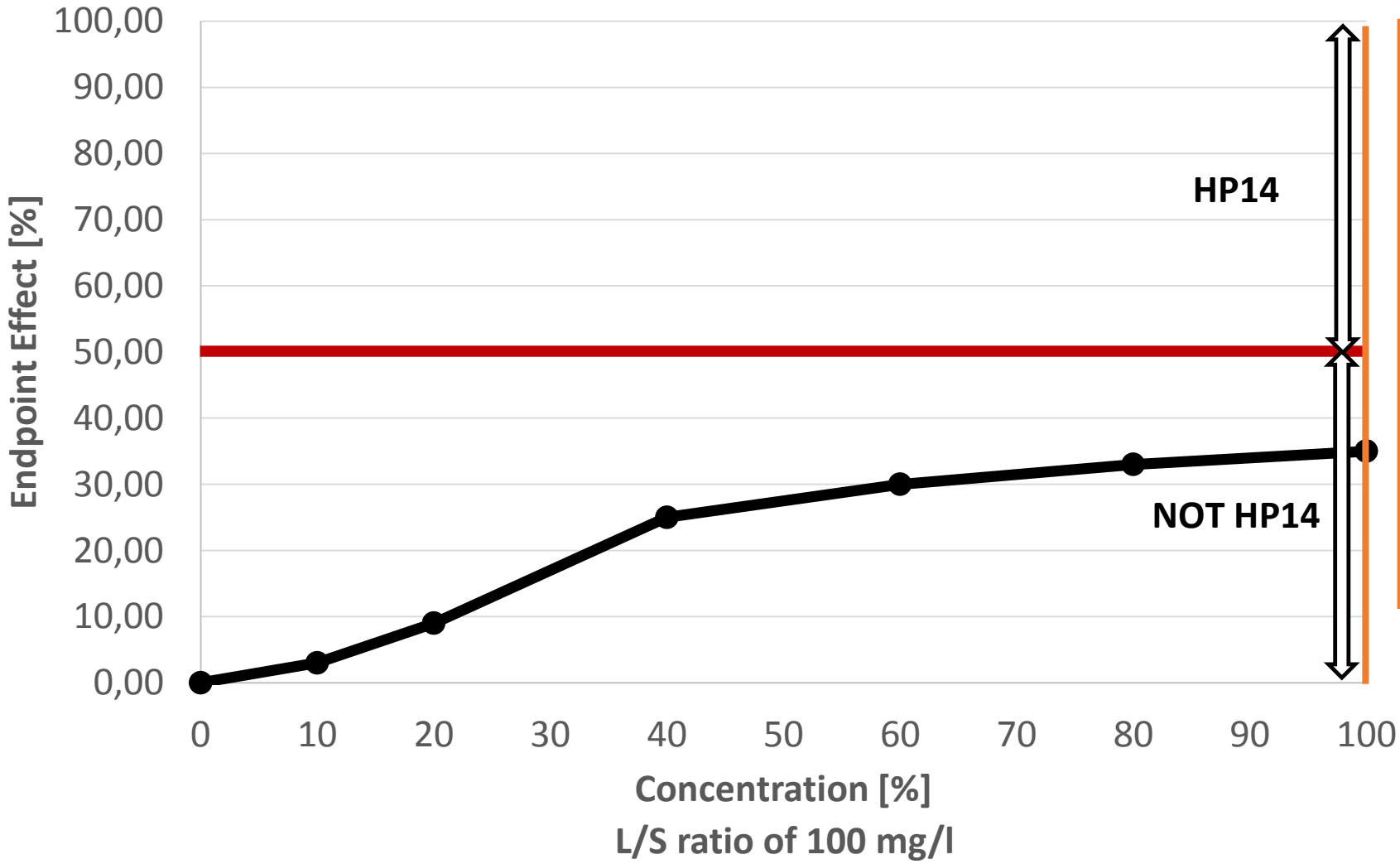
EN 14735 – Hennebert, 2018		
Organism	**Standard**	**Limit**
Crustaceans (Daphnia)	EN ISO 6341	EC50≤15,8%
Algae (Pseudokirchneriella subcapitata)	EN ISO 8692	EC50≤7,03%
Aquatic Bacteria (Vibrio Fisheri)	EN ISO 11348-3	EC50≤7,95%
Soil Bacteria (Arthrobacter globiformis)	ISO 18187	EC50≤2,25%
Plants (Brassica Rapa)	EN ISO 11269-2	EC50≤13,7%
Soil Invertebrates (Eisenia fetida)	ISO 17512-1	EC50≤3,75%

MATERIALS and METHODS
INTERNATIONAL STANDARDS FOR ECOTOX TESTING

	EN ISO 6341	OECD TG 202/C2
Test organism	Daphnids (neonates)	Daphnids (neonates)
Age of test organism	< 24 h	< 24 h
Feeding	None	None
Dilution medium	Freshwater or synthetic reconstituted medium (dechlorinated tap water)	Any water suitable for culturing, natural or reconstituted water
Water hardness	140-275 mg/l CaCO3/L	140-250 mg CaCO3/L
Volume	10 ml	Minimum 10 ml/replicate
Test conditions	(20 ± 2) °C	(20 ± 2) °C
Temperature		
Ph	7 - 8 ± 0,2	6 - 9
Photoperiod	Darkness or 16 h + 8 h light + dark photoperiod	Darkness or 16 of light
Number of containers, number of replicates	5 daphnids per vessel 4 replicates	20/concentration 4 replicates (5 animal each)
Test duration	24 h and/or 48 h	48 h
Validity criteria	• Control mortality ≤ 10 %; • 0_2 concentration ≥ 2 mg/l; • sensitivity to K2Cr2O7	• ≤ 10% individuals immobile or trapped at the surface of the water in control; • Dissolved O_2 ≥ 3 mg/L in all concentrations
Test parameters	Immobilisation	Immobilisation
Endpoints	EC 50	EC 50

- Testing procedures are **comparable**;
- **Minor differences**;
- Further experimental activity needed to **confirm assumptions**

MATERIALS and METHODS – ECOTOXICOLOGICAL LIMITS for CLP



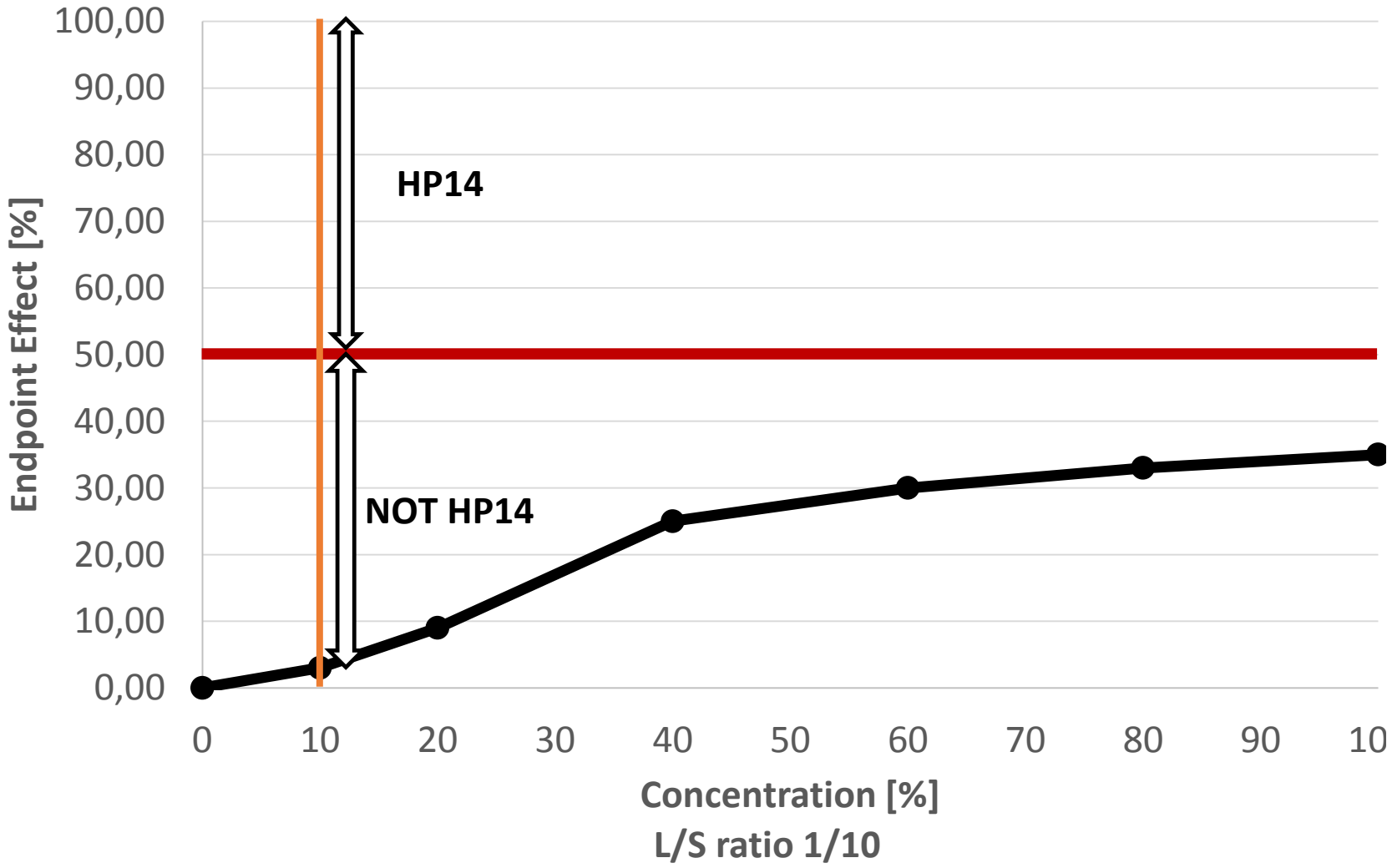
Ecotox Chronic (III) if :

EC50 ≤ 100 mg/l

- C=100 mg/l is considered equivalent to a concentration C=100 % (vol/vol) of a water extract derived according to L/S ratio of 100 mg/l.

MATERIALS and METHODS –ECOTOXICOLOGICAL

LIMITS for EN 14735 (Pandard and Rombke, 2014 Hennebert, 2018 , ISS/ISPRA, 2011)



HP14 if :

EC50 ≤ 10 % (vol/vol)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Proposal for a "Harmonized" Strategy for the Assessment of the HP 14 Pro

Pascal Pandard*† and Jörg Rö

Proposal of concentration 14 for waste using ecoto

Pierre Hennebert

Edited by Heidrun Moser and Jörg Römbke

Ecotoxicological Characterization of Waste

Results and Experiences of an International Ring Test

Springer

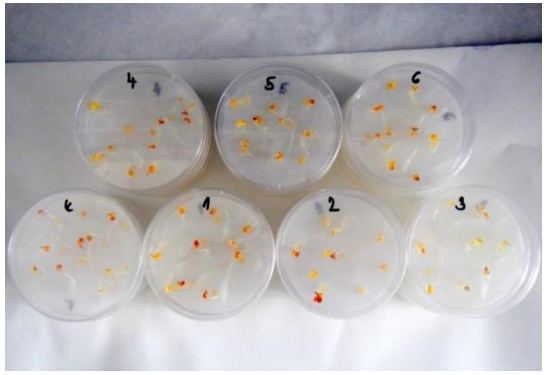
MATERIALS and METHODS – ECOTOX PRELIMINARY ASSESSMENT

Plants

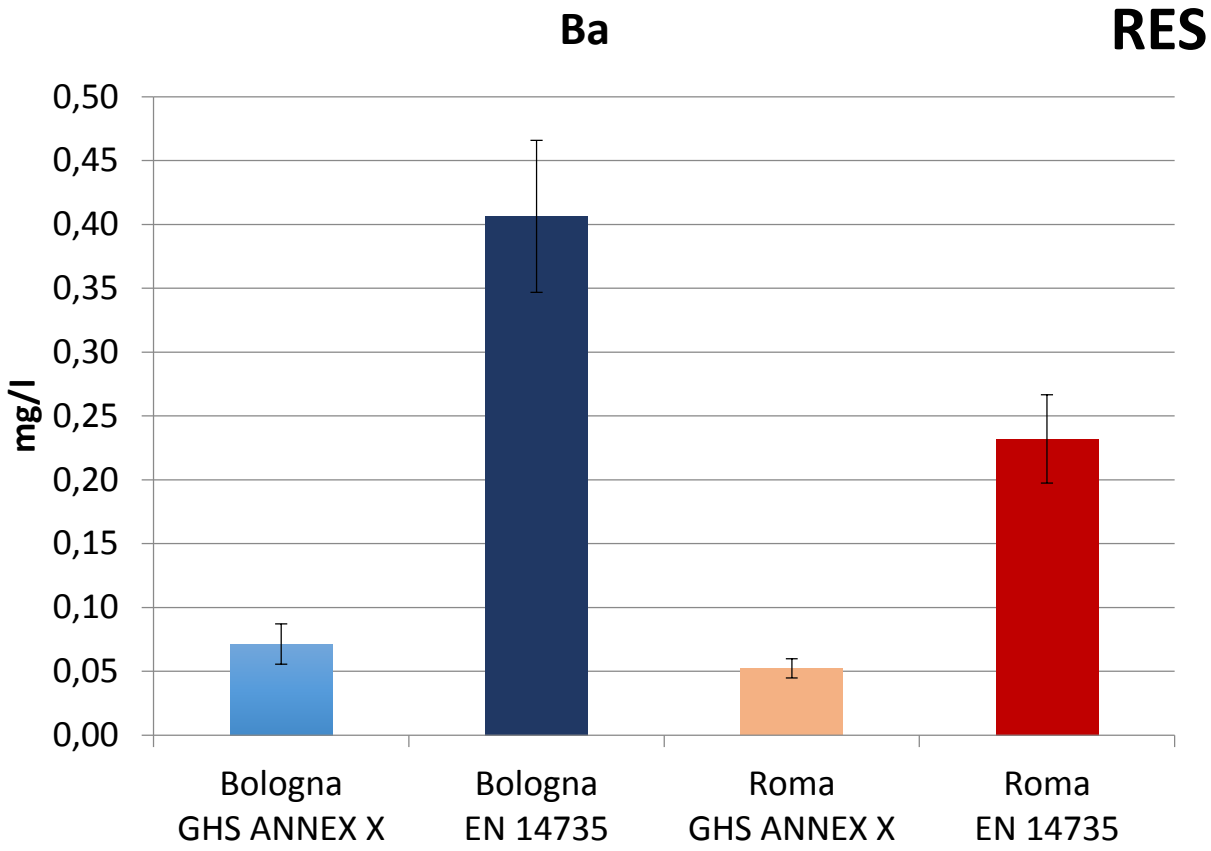
(*Lepidium Sativum*)

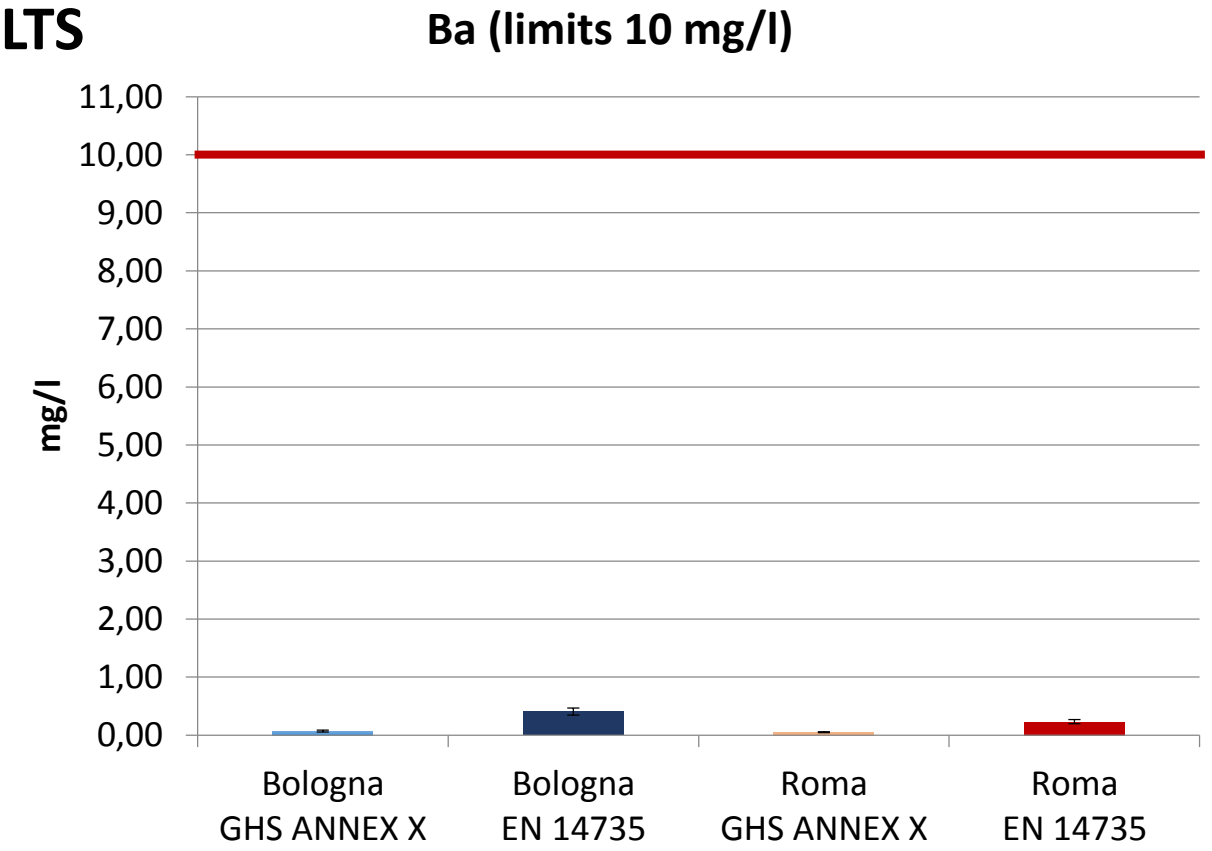
Seed Germination Bioassay

- APAT, 2004 - UNICHIM Metodo 1651/2003
- Endpoints: Germination Index (%)
- 72 hr test
- 7 concentration of water extracts (control included)
- 4 Replicates for each concentration
- 10 seeds per replicate
- 5 ml of tested sample per replicate
- Limits: EC50 ≤ 10% (vol/vol)



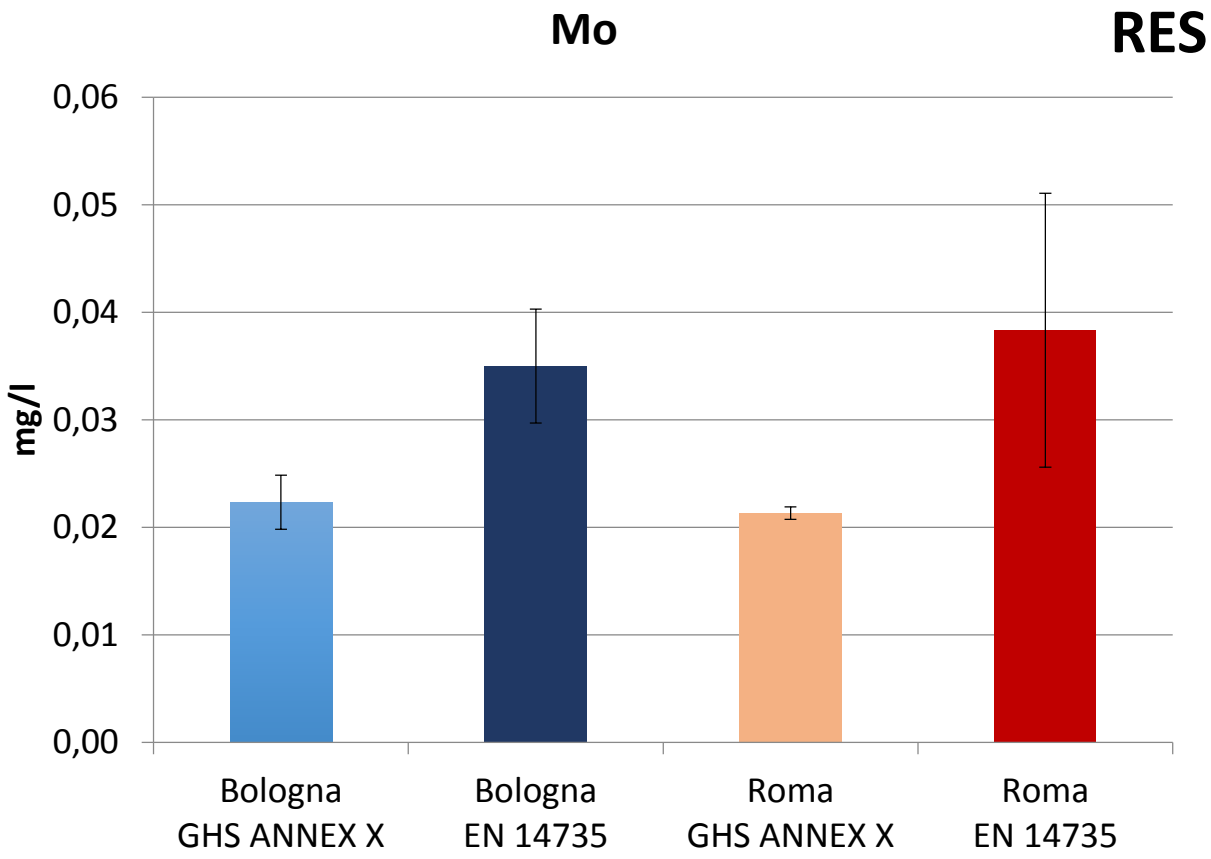
RESULTS

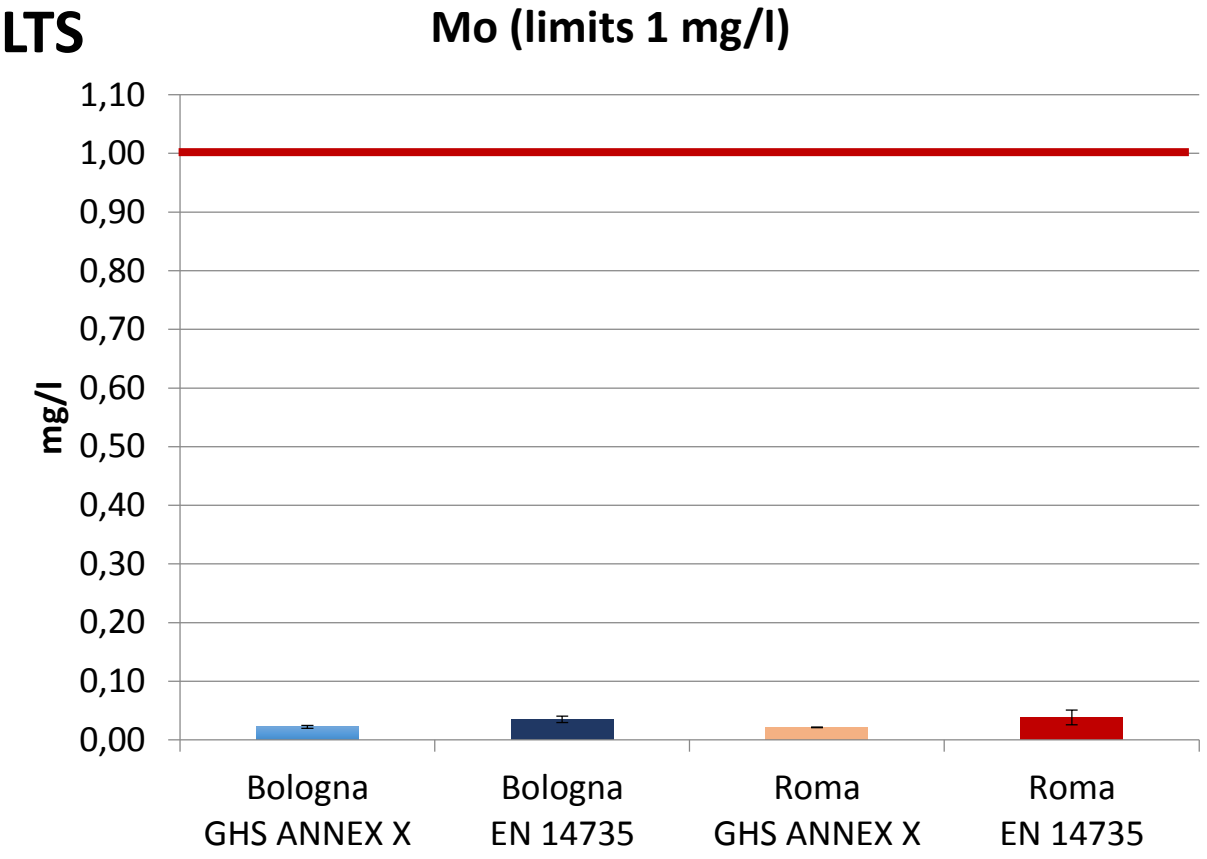




	Bologna GHS ANNEX X	Bologna EN 14735	Roma GHS ANNEX X	Roma EN 14735	Bologna REFERENCE EN 14735	Roma REFERENCE EN 14735	Limits DM 27/09/10
Ba mg/l	0,071	0,406	0,052	0,232	0,200	1,657	10
	±0,016	±0,060	±0,008	±0,035	-	-	

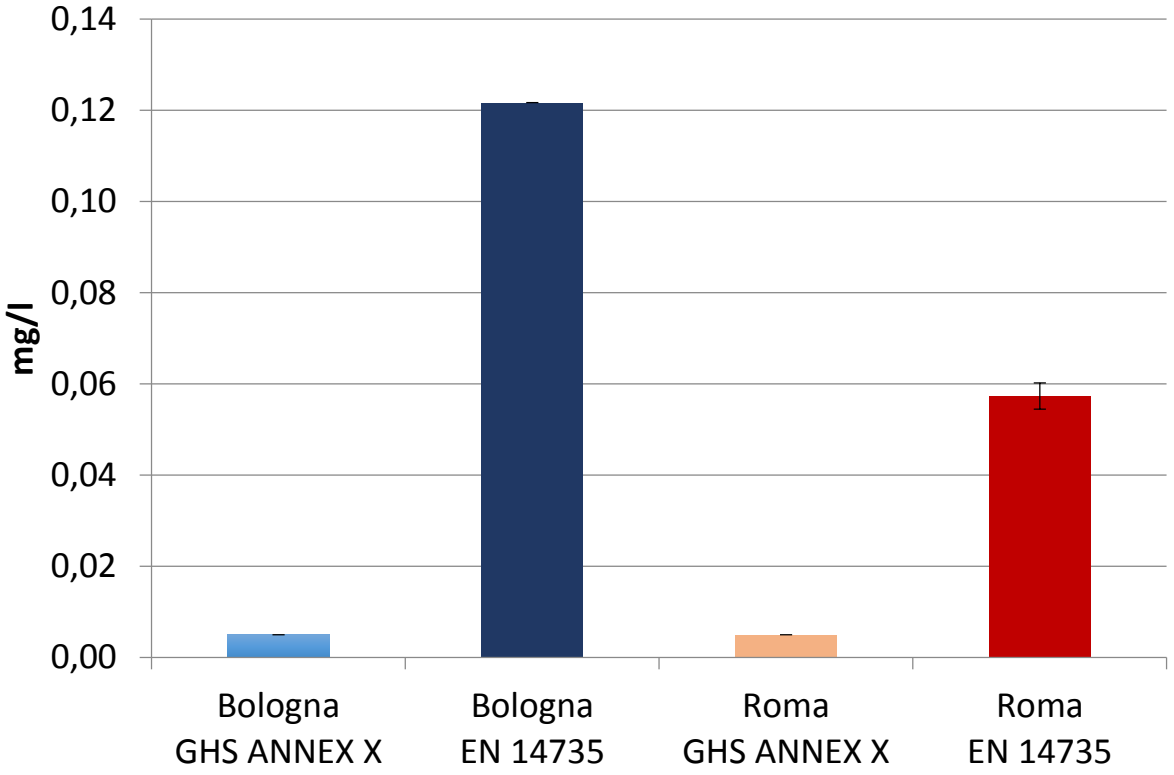
RESULTS

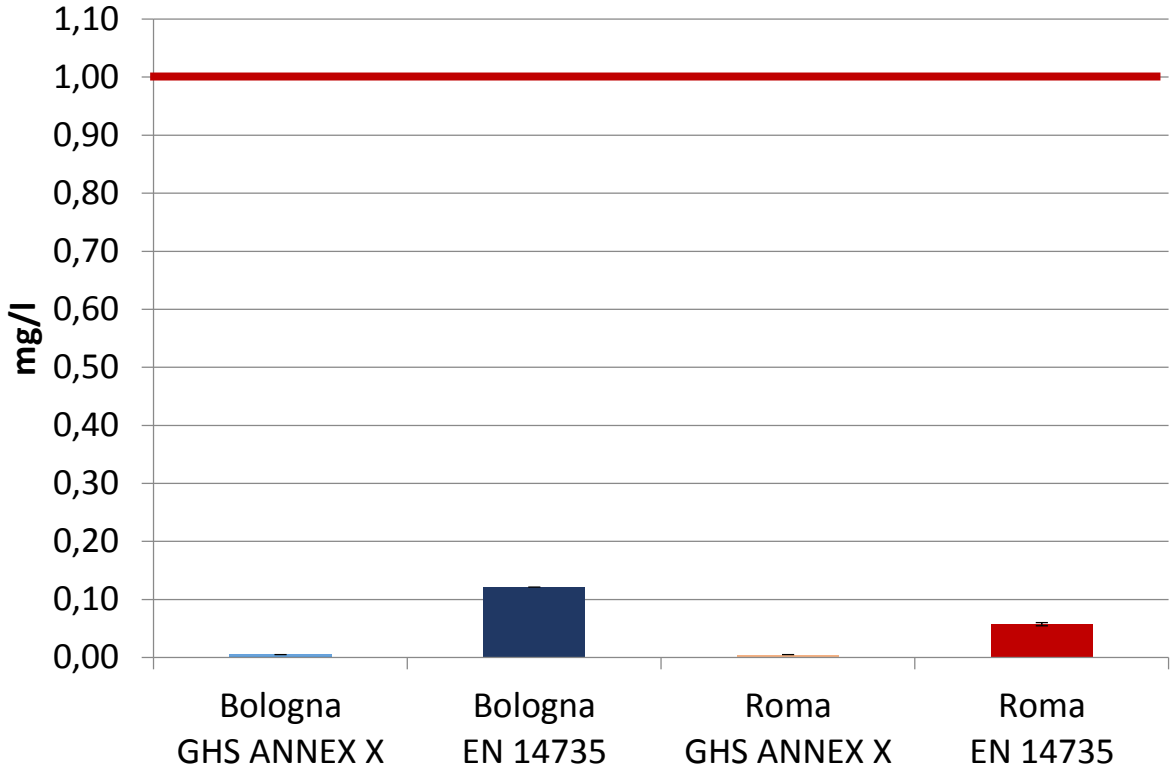




	Bologna GHS ANNEX X	Bologna EN 14735	Roma GHS ANNEX X	Roma EN 14735	Bologna REFERENCE EN 14735	Roma REFERENCE EN 14735	Limits DM 27/09/10
Mo mg/l	0,022	0,035	0,021	0,038	0,093	0,084	1
	±0,003	±0,005	±0,001	±0,013	-	-	

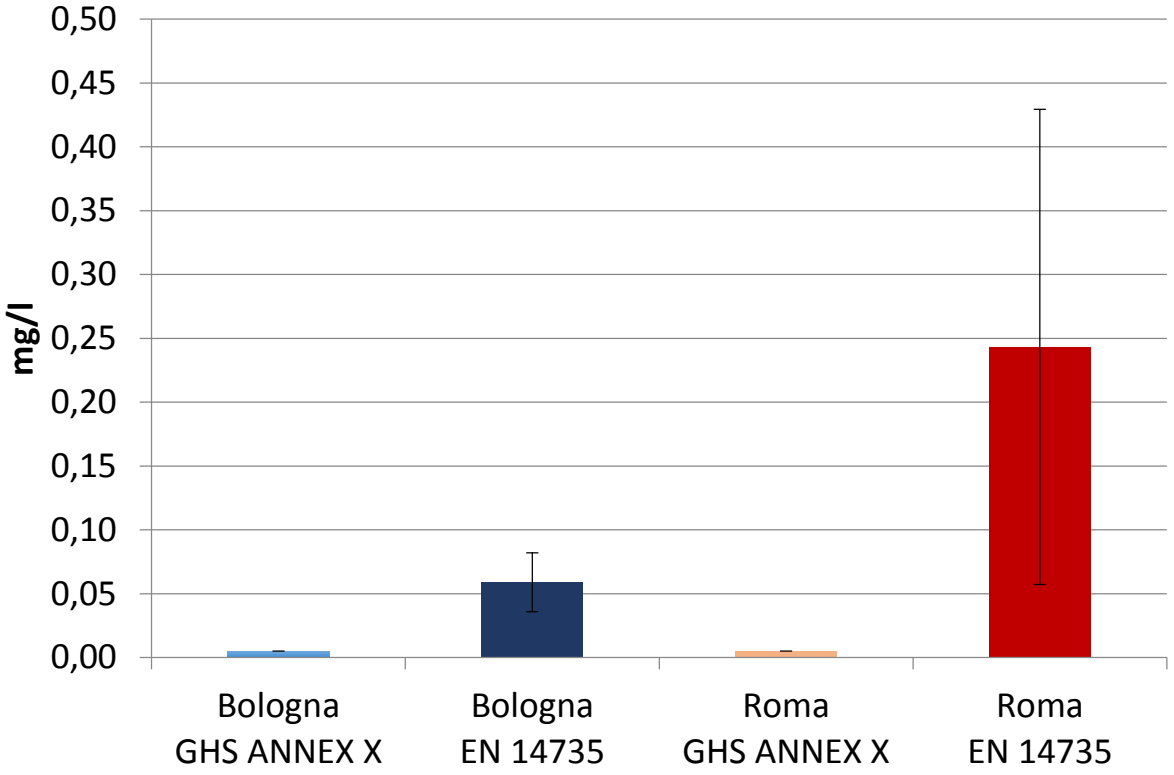
RESULTS

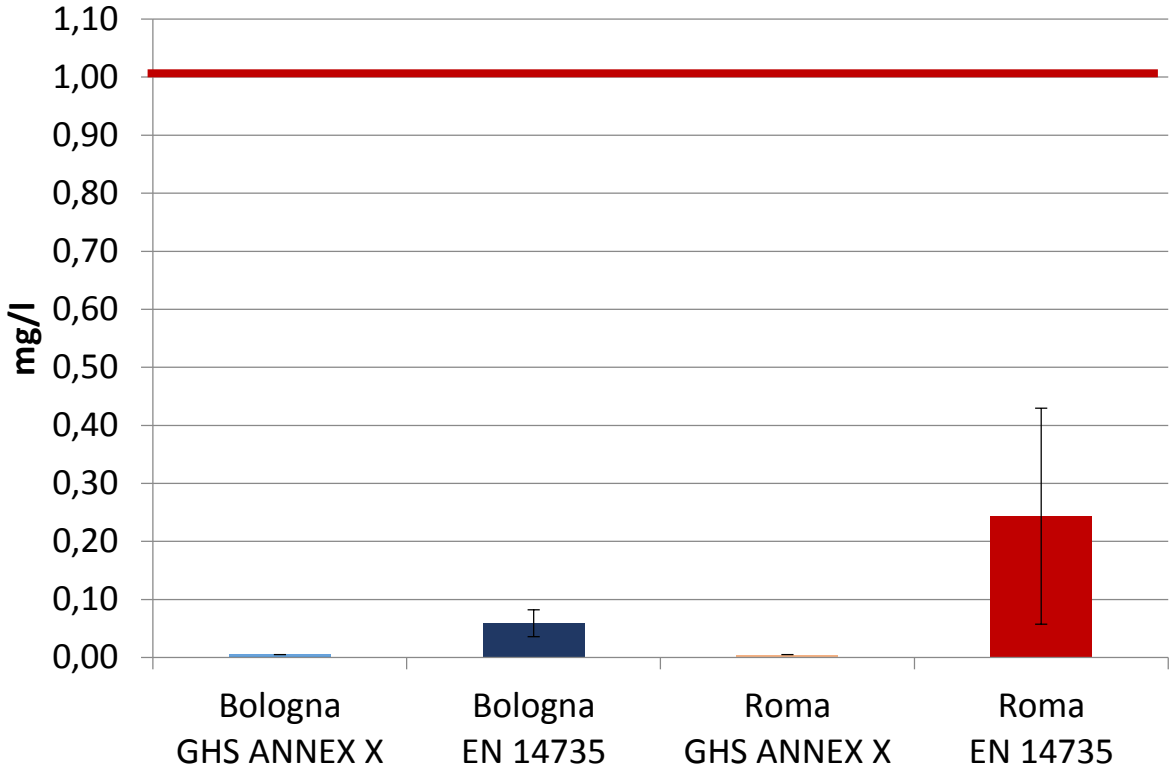




	Bologna GHS ANNEX X	Bologna EN 14735	Roma GHS ANNEX X	Roma EN 14735	Bologna REFERENCE EN 14735	Roma REFERENCE EN 14735	Limits DM 27/09/10
Ni mg/l	0,005	0,122	0,005	0,057	0,211	0,061	1
	±0,000	±0,000	±0,000	±0,003	-	-	

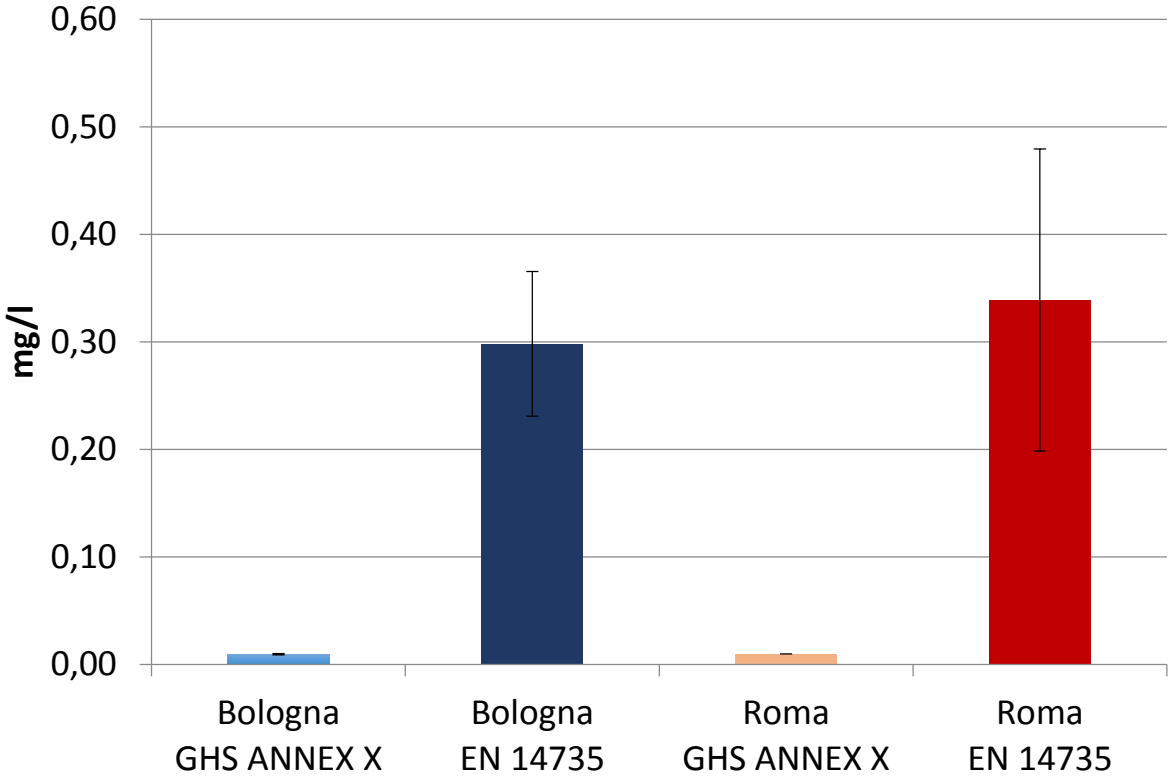
RESULTS

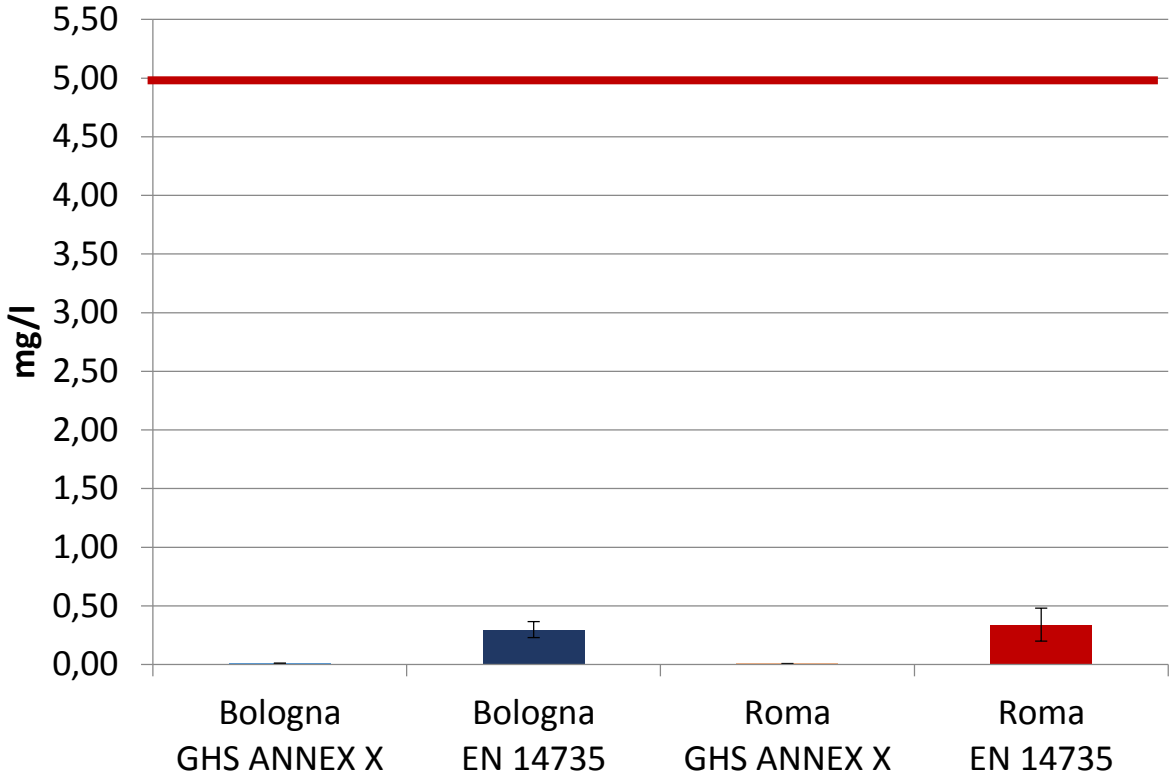




	Bologna GHS ANNEX X	Bologna EN 14735	Roma GHS ANNEX X	Roma EN 14735	Bologna REFERENCE EN 14735	Roma REFERENCE EN 14735	Limits DM 27/09/10
Pb mg/l	0,005	0,059	0,005	0,243	0,058	0,071	1
	±0,000	±0,023	±0,000	±0,186	-	-	

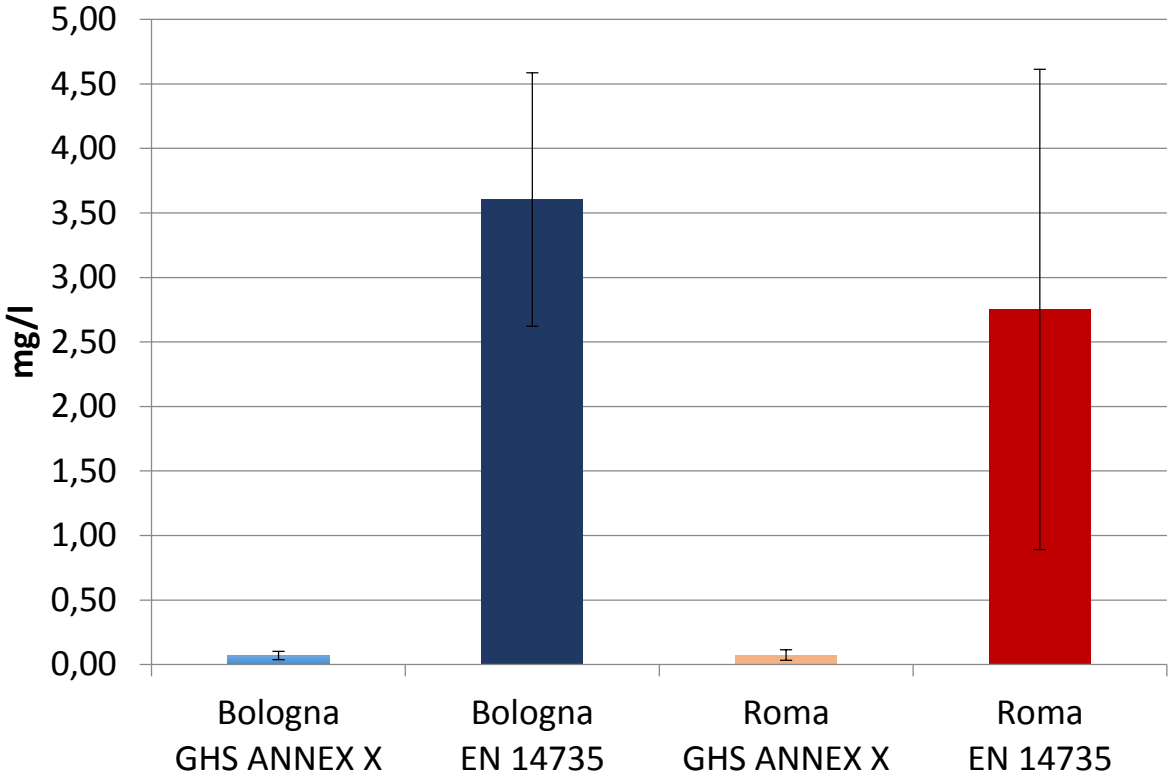
RESULTS

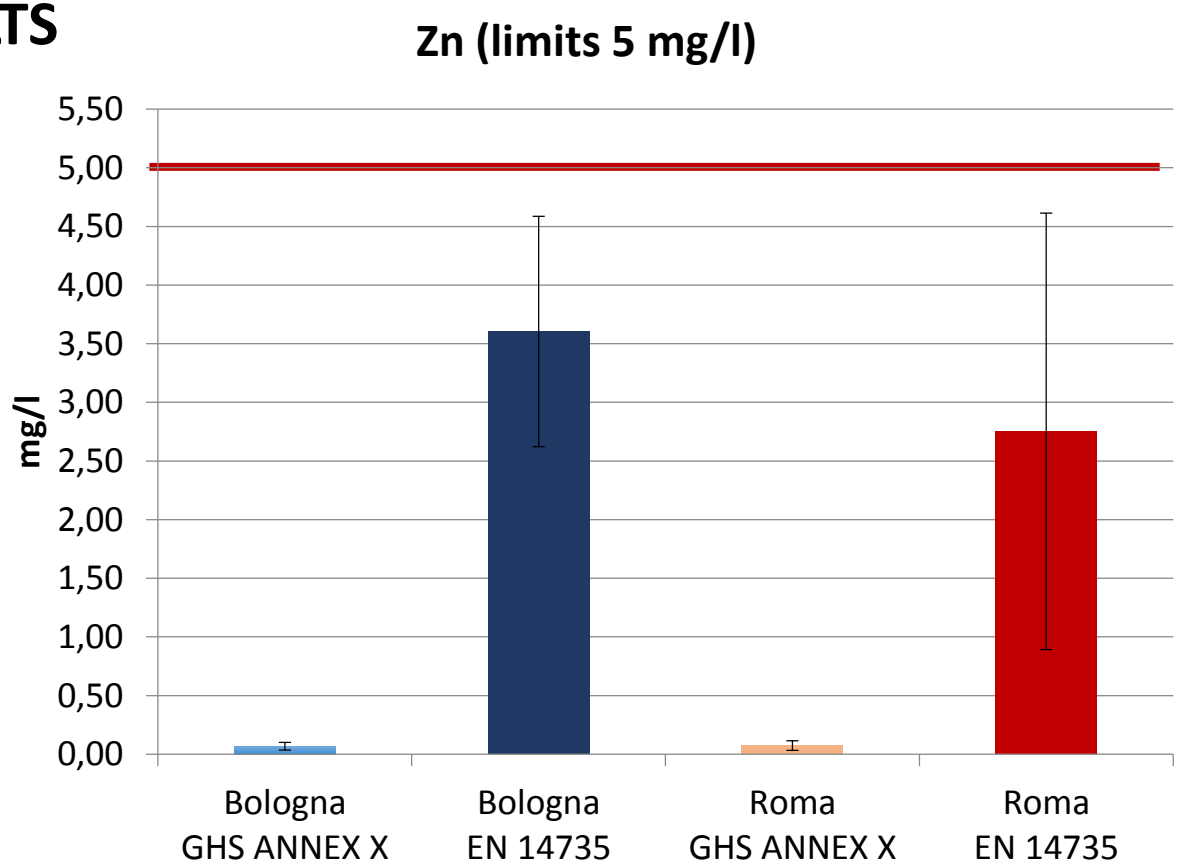




	Bologna GHS ANNEX X	Bologna EN 14735	Roma GHS ANNEX X	Roma EN 14735	Bologna REFERENCE EN 14735	Roma REFERENCE EN 14735	Limits DM 27/09/10
Cu mg/l	0,010	0,298	0,010	0,339	0,267	0,112	5
	±0,001	±0,067	±0,000	±0,140	-	-	

RESULTS

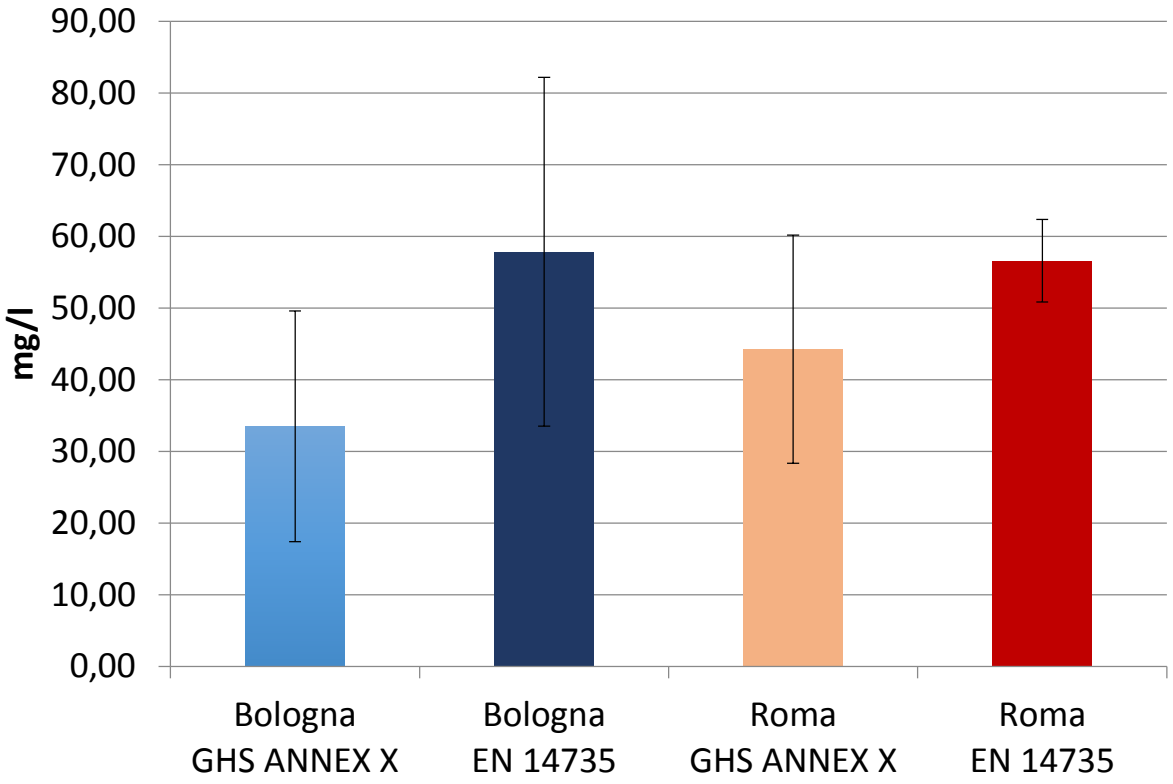




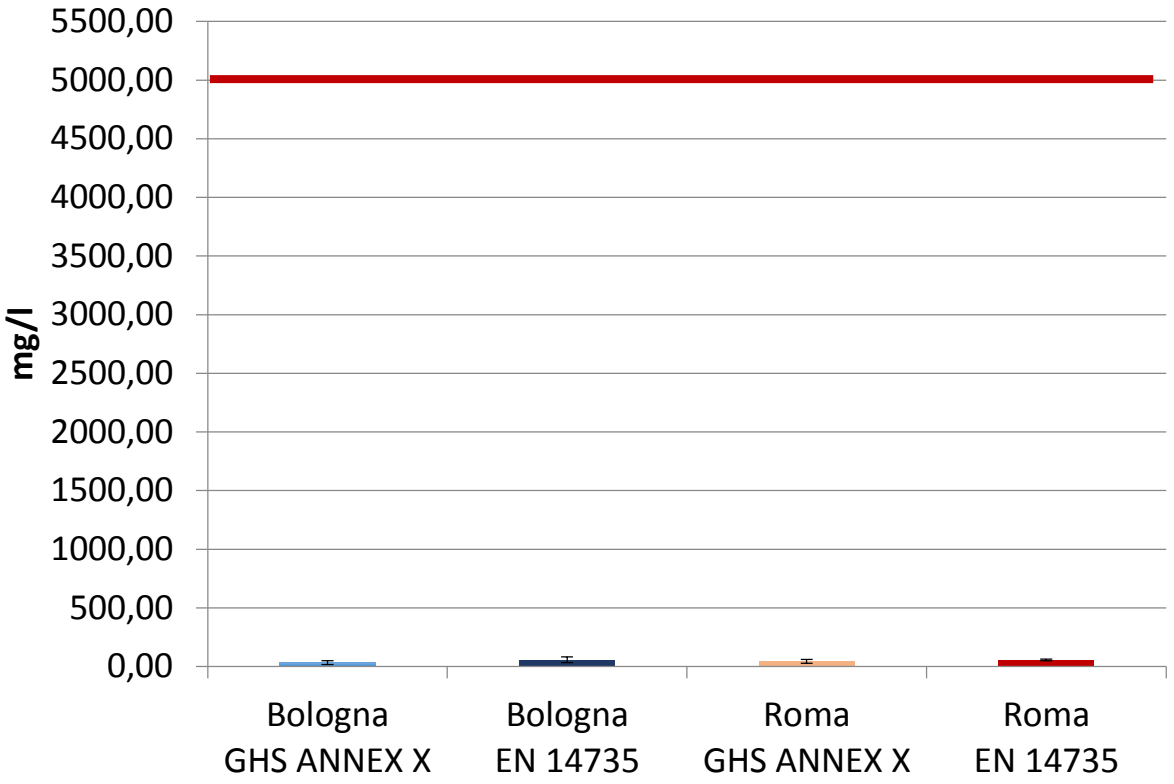
	Bologna GHS ANNEX X	Bologna EN 14735	Roma GHS ANNEX X	Roma EN 14735	Bologna REFERENCE EN 14735	Roma REFERENCE EN 14735	Limits DM 27/09/10
Zn mg/l	0,069	3,604	0,074	2,752	2,553	1,085	5
	0,032	0,981	0,041	1,861	-	-	

RESULTS

Sulphates

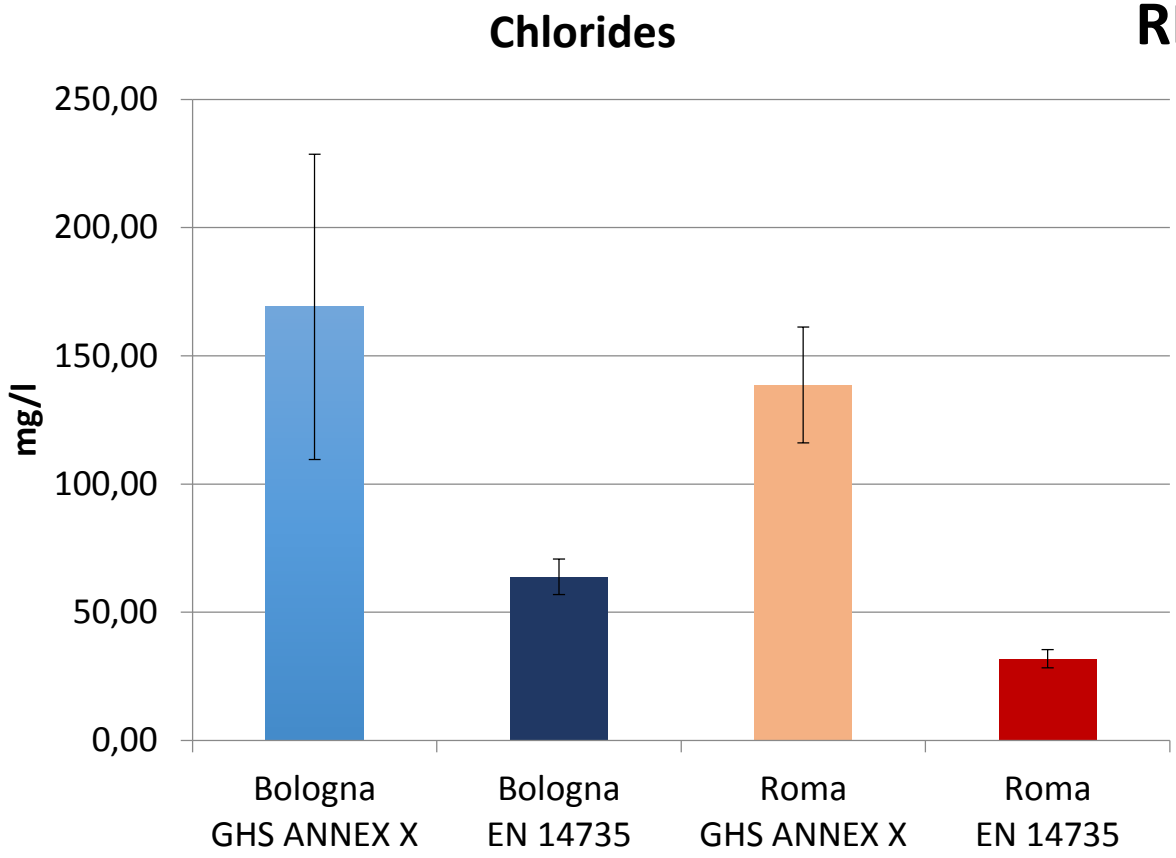


Sulphates (limits 5000 mg/l)



	Bologna GHS ANNEX X	Bologna EN 14735	Roma GHS ANNEX X	Roma EN 14735	Bologna REFERENCE EN 14735	Roma REFERENCE EN 14735	Limits DM 27/09/10
Sulphates (SO_4^{2-}) mg/l	33,499	57,855	44,270	56,615	71,011	79,538	5000
	±16,100	±24,332	±15,914	±5,761	-	-	

RESULTS



GHS ANNEX X

Average Concentration of Chlorides in the Leaching Media

≈ 150 mg/l

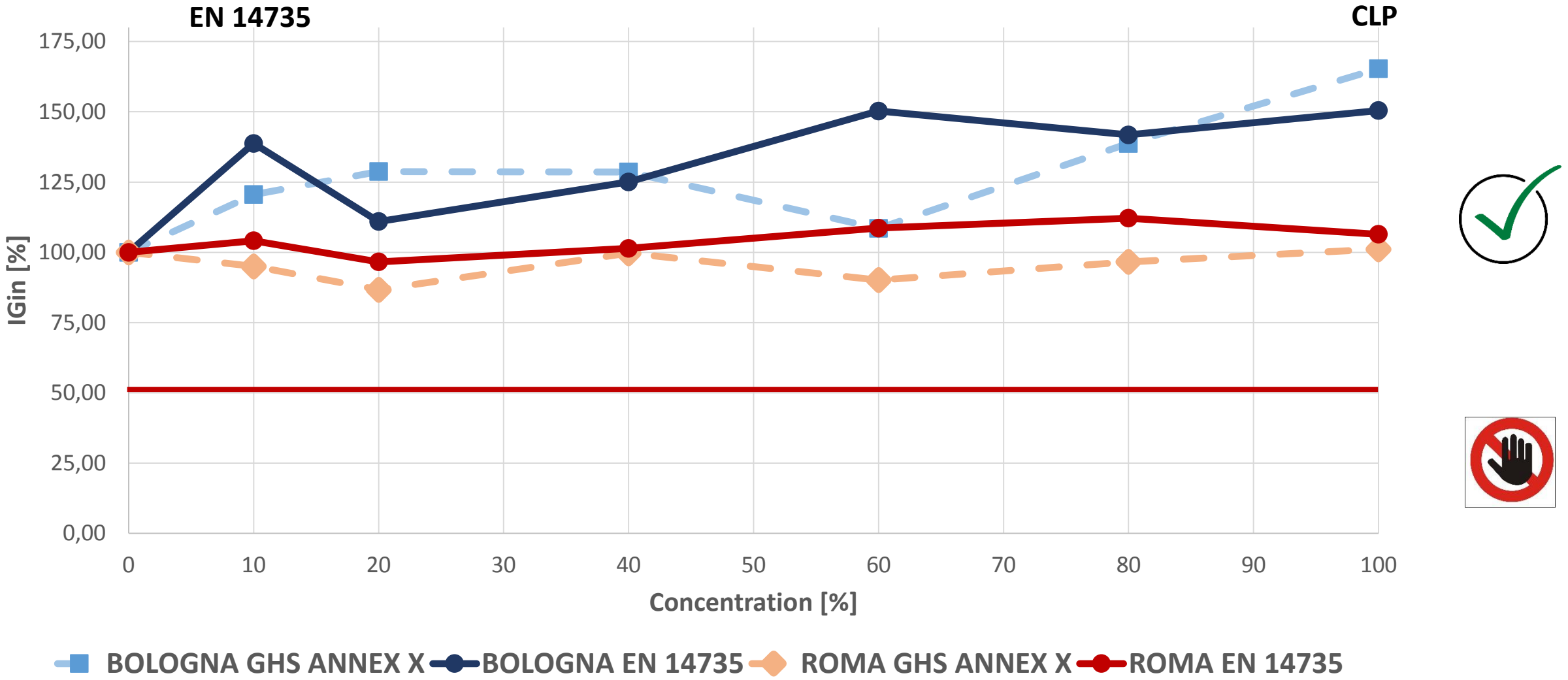
The limits of 2500 mg/l is largely respected

	Bologna GHS ANNEX X	Bologna EN 14735	Roma GHS ANNEX X	Roma EN 14735	Bologna REFERENCE EN 14735	Roma REFERENCE EN 14735	Limits DM 27/09/10
Cloruri (come Cl^-) mg/l	169,130	63,846	138,637	31,911	46,921	48,893	2500
	±59,552	±6,876	±22,573	±3,563	-	-	

RESULTS

			Cd	Cr	Hg	Ag	Be
Source	Protocol	Replicate	ug/L	ug/L	ug/L	ug/L	ug/L
Bologna	GHS Annex X	1	< 1	< 5	< 0,5	< 5	< 1
Bologna	GHS Annex X	2	< 1	< 5	< 0,5	< 5	< 1
Bologna	GHS Annex X	3	< 1	< 5	< 0,5	< 5	< 1
Bologna	EN 14735	1	1,30	< 5	< 0,5	< 5	< 1
Bologna	EN 14735	2	1,26	< 5	< 0,5	< 5	< 1
Bologna	EN 14735	3	1,98	6,12	< 0,5	< 5	< 1
Roma	GHS Annex X	1	< 1	< 5	< 0,5	< 5	< 1
Roma	GHS Annex X	2	< 1	< 5	< 0,5	< 5	< 1
Roma	GHS Annex X	3	< 1	< 5	< 0,5	< 5	< 1
Roma	EN 14735	1	2,01	18	0,96	< 5	< 1
Roma	EN 14735	2	1,41	16	< 0,5	< 5	< 1
Roma	EN 14735	3	< 1	< 5	< 0,5	< 5	< 1

RESULTS – GERMINATION INDEX

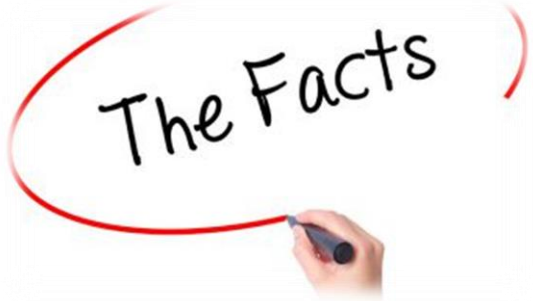


CONCLUSIONS

- **Data** obtained by this study **are consistent with reference data** from the period 2016-2018;
- Chemical **concentrations on water extracts obtained from EN 14735 are higher** than chemical concentrations derived from GHS ANNEX X;

Leaching test according to **EN 14735 proved to be more conservative**

- The only case in which the chemical concentration on water extracts is higher than GHS ANNEX X is due to the presence of chlorides in the media;
- Preliminary ecotoxicological tests are **consistent with proposed Limits.**
- **PROCEDURE and LIMITS validated by the scientific community already exist!!!**



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- **Hennebert, P., 2018**. Proposal of concentration limits for determining the hazard property HP 14 for waste using ecotoxicological tests. Waste Manag. 74, 74–85. https://doi.org/10.1016/j.wasman.2017.11.048
- **Pandard, P., Römbke, J., 2013**. Proposal for a "Harmonized" strategy for the assessment of the HP 14 property. Integr. Environ. Assess. Manag. 9, 665–672. https://doi.org/10.1002/ieam.1447
- **997/2017/EC** - Council Regulation No 2017/997 of 8 June 2017 amending Annex III to Directive 2008/98/EC of the European Parliament and of the Council as regards the hazardous property HP 14 'Ecotoxic'
- **EN 14735:2005**, Characterization of waste – Preparation of waste samples for ecotoxicity tests. CEN, Brussels, Belgium.
- **OECD, 2001**. OECD Series on Testing and Assessment, Number 29. ANNEX 10. Guidance on Transformation/Dissolution of Metals and Metal Compounds in Aqueous Media. S 525–537.
- **ISS/ISPRA** 29/09/2011 Prot. ISS n. 40823

THANKS FOR THE ATTENTION!

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