Composting of brewery sludge mixed with different bulking agents

E. Kalatzi[1,2], E. Sazakli[2], H.K. Karapanagioti[1] and M. Leotsinidis[2]

[1] Department of Chemistry, University of Patras, Patras, GR-26504, Greece

[2] Lab of Public Health, School of Medicine, University of Patras, Patras, GR-26504, Greece

Introduction

- Re-use of waste is the key for sustainable development

- Sludge is **NOT** a waste
- It is rather a source of nutrients
- Composting: one of the most promising technologies allowing recycling of biosolids

Why brewery sludge?

- ✓ Solid-waste disposal problem and management
- ✓ European Directives 2006/799/EC and 2007/799/EC

Composting requires

- ✓ Biosolids
- ✓ Bulking agents

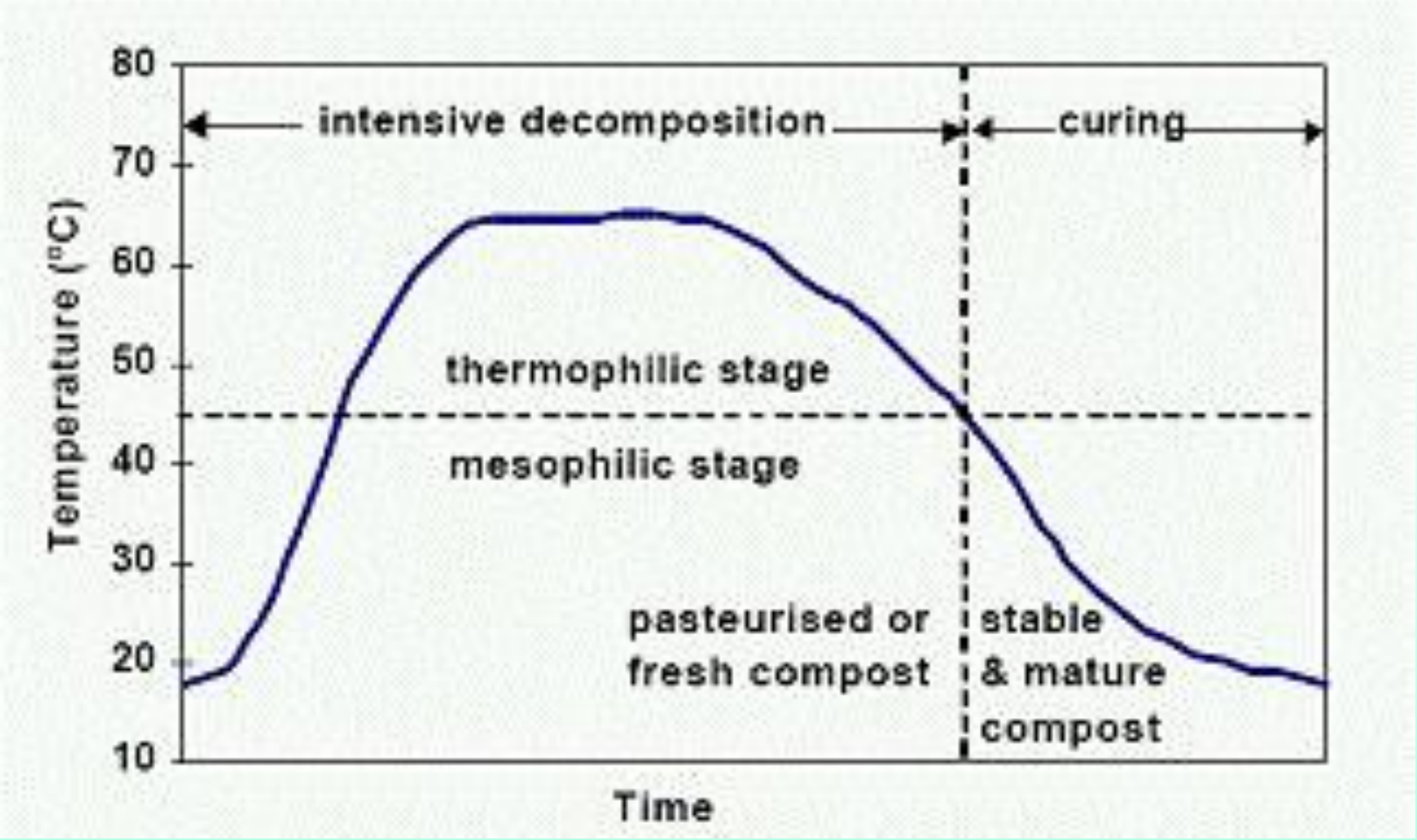
Purpose

Composting of brewery sludge with three different bulking agents

Parameters

- Temperature
- Moisture
- pH
- Conductivity
- Volatile solids
- Organic Nitrogen
- Carbon to nitrogen ratio
- Total phosphorus
- Metals
- Microbiological quality

Composting Stages



Composting set-up

- 3 co-composting materials – lignite
  – sawdust
  – dried shredded grass
- Temperature measurement three times per week
- Agitation once per week
- Sampling once per week before agitation

Location …

Greenhouse of University of Patras

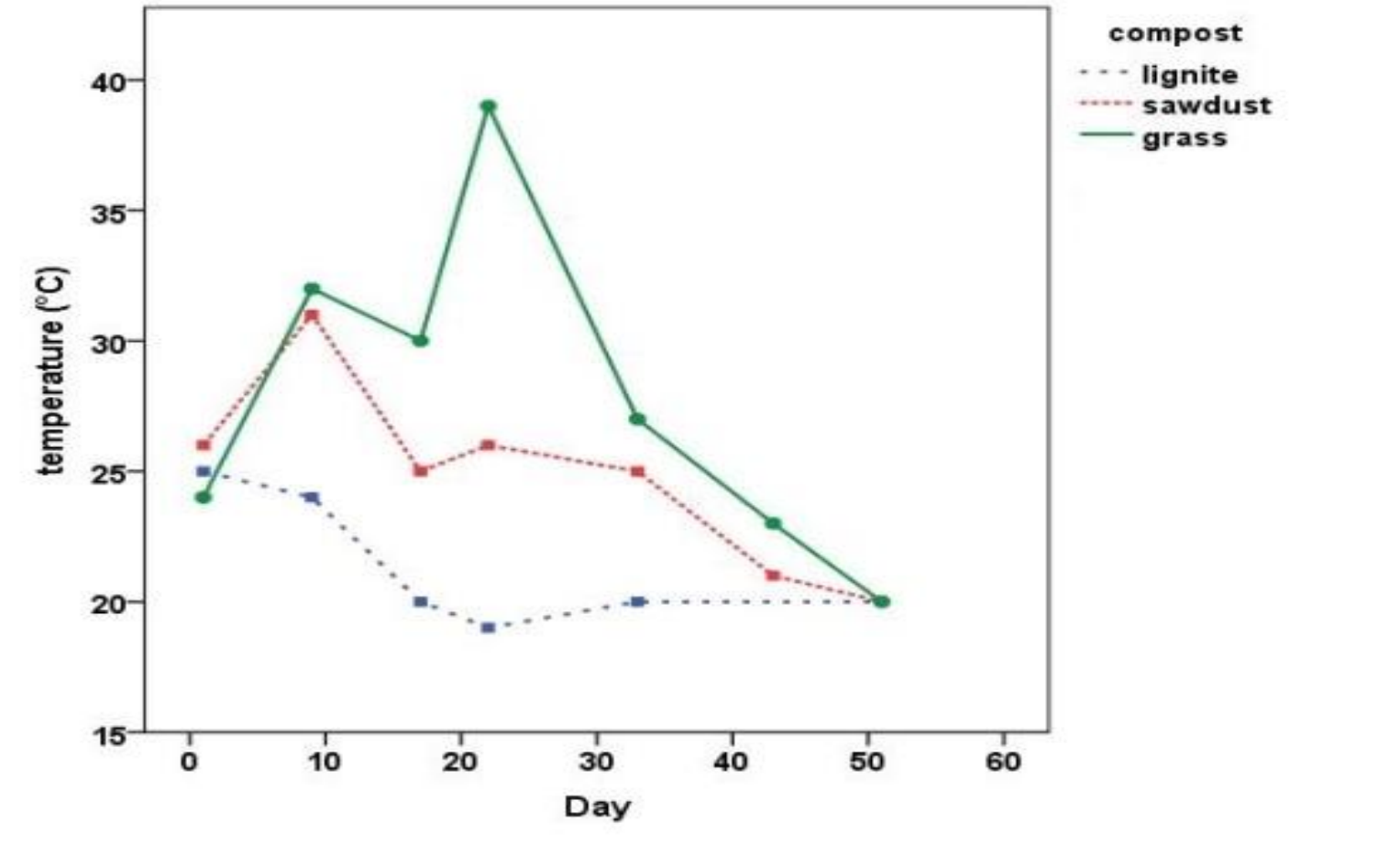
Sludge + lignite

Sludge + sawdust

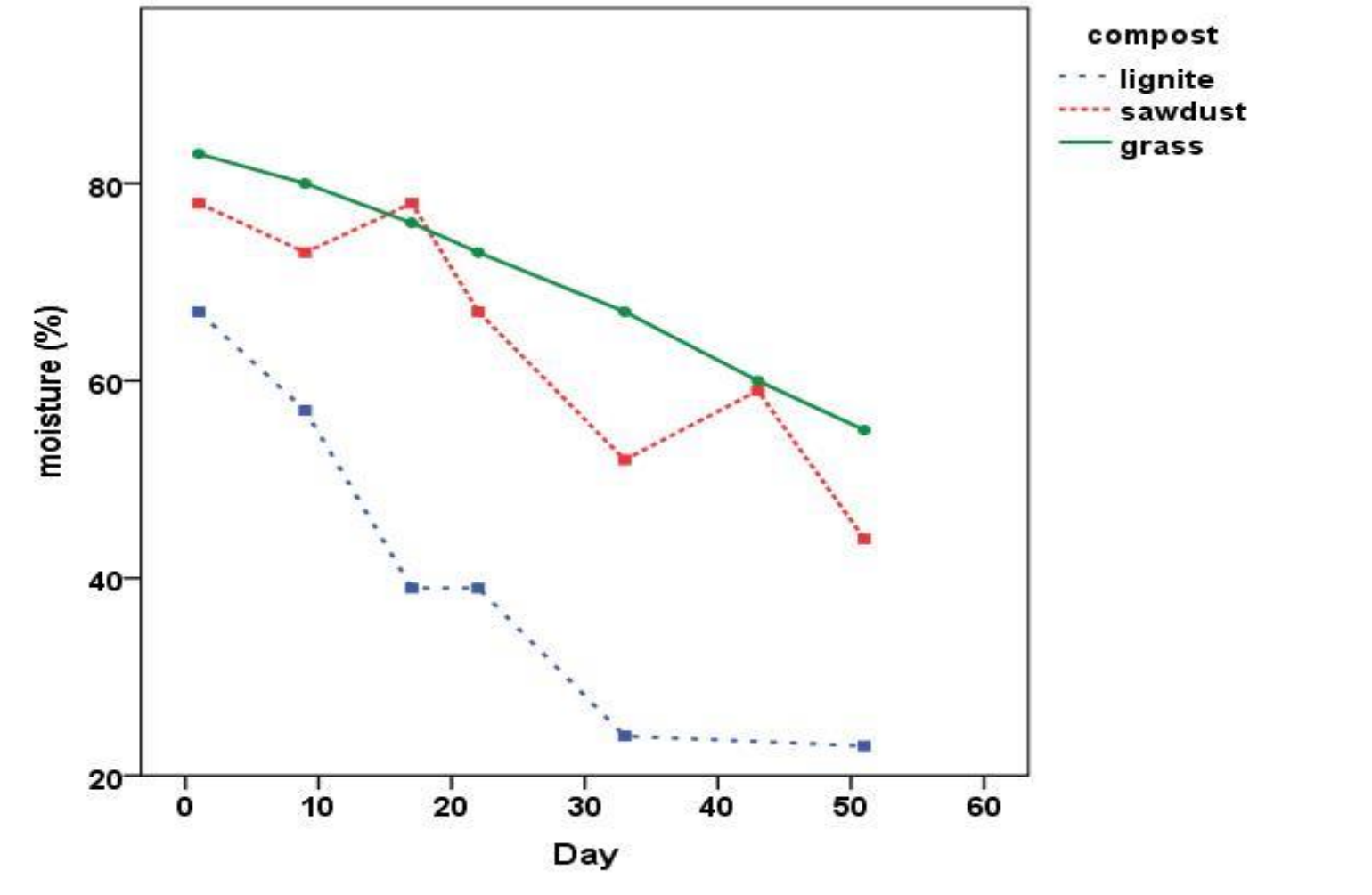
Sludge + shredded grass

Results

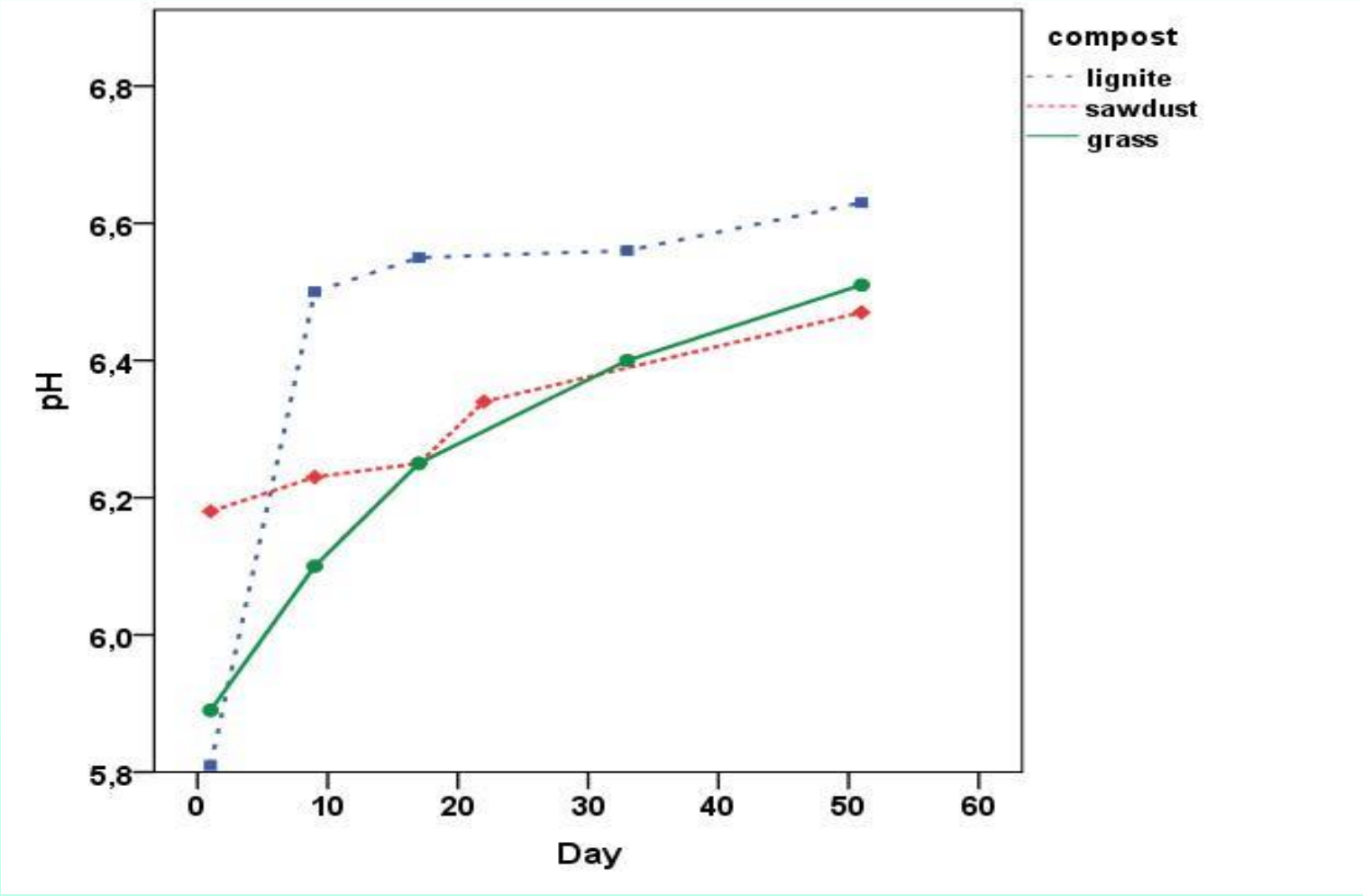
Temperature



Moisture


compost
lignite
sawdust
grass
moisture (%)
80
60
40
20
0
10
20
30
40
50
60
Day

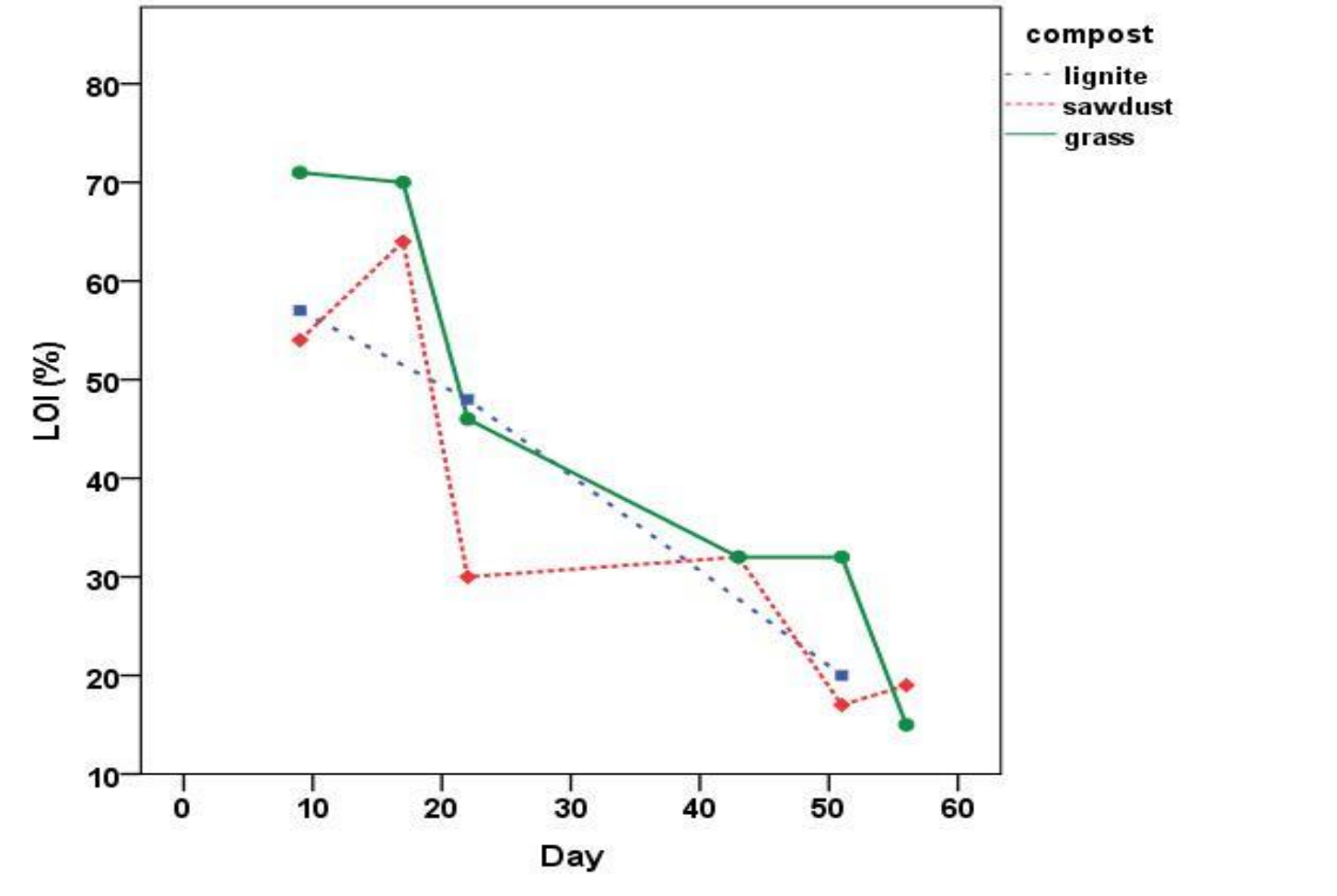
pH


compost
lignite
sawdust
grass
6,8
6,6
6,4
6,2
6,0
5,8
pH
0
10
20
30
40
50
60
Day

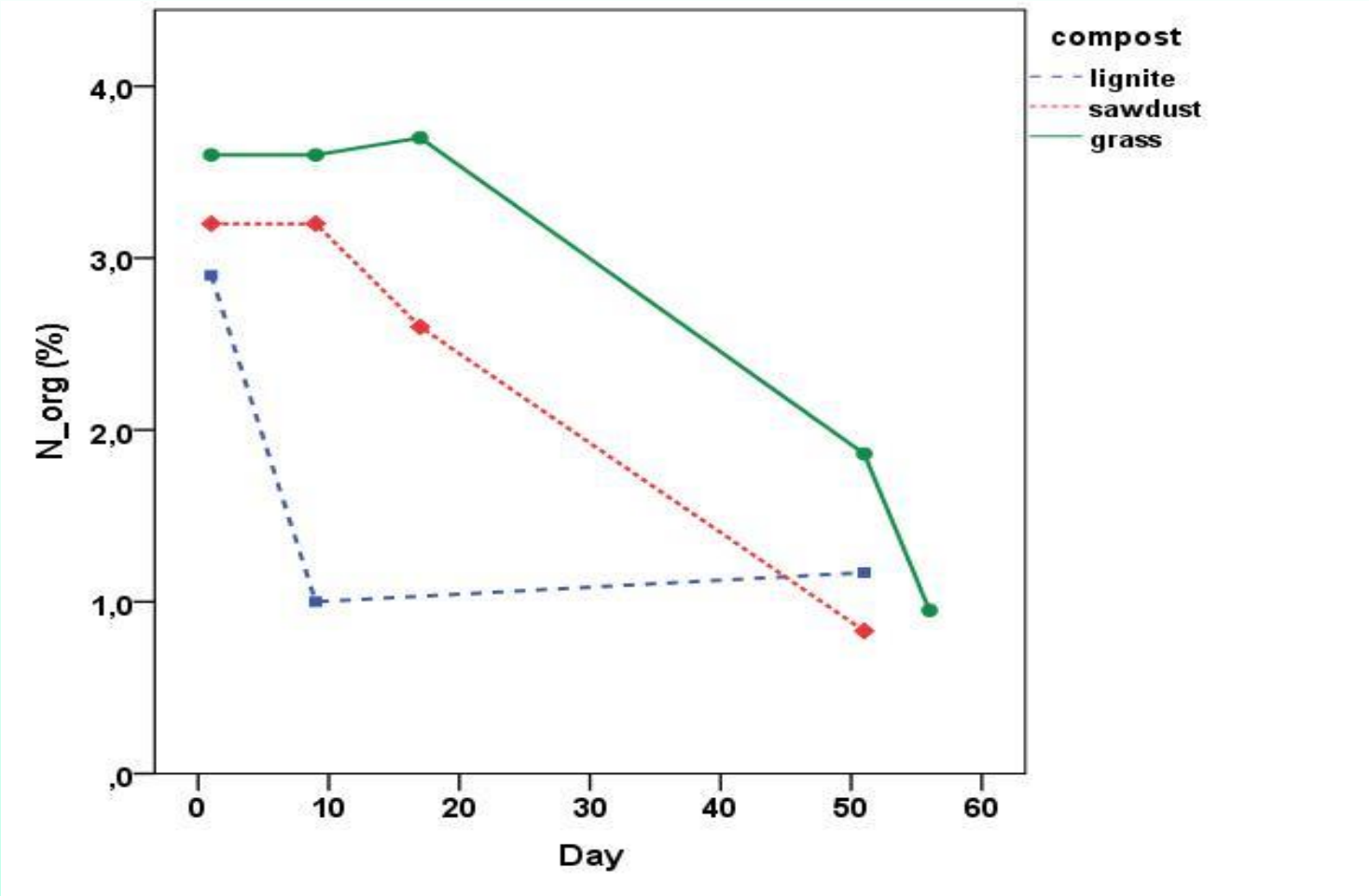
Electrical conductivity

Composts	**Final Values** (mS/cm)
Grass mixture	3.3
Lignite mixture	1.8
Sawdust mixture	1.1

Volatile Solids



Organic nitrogen

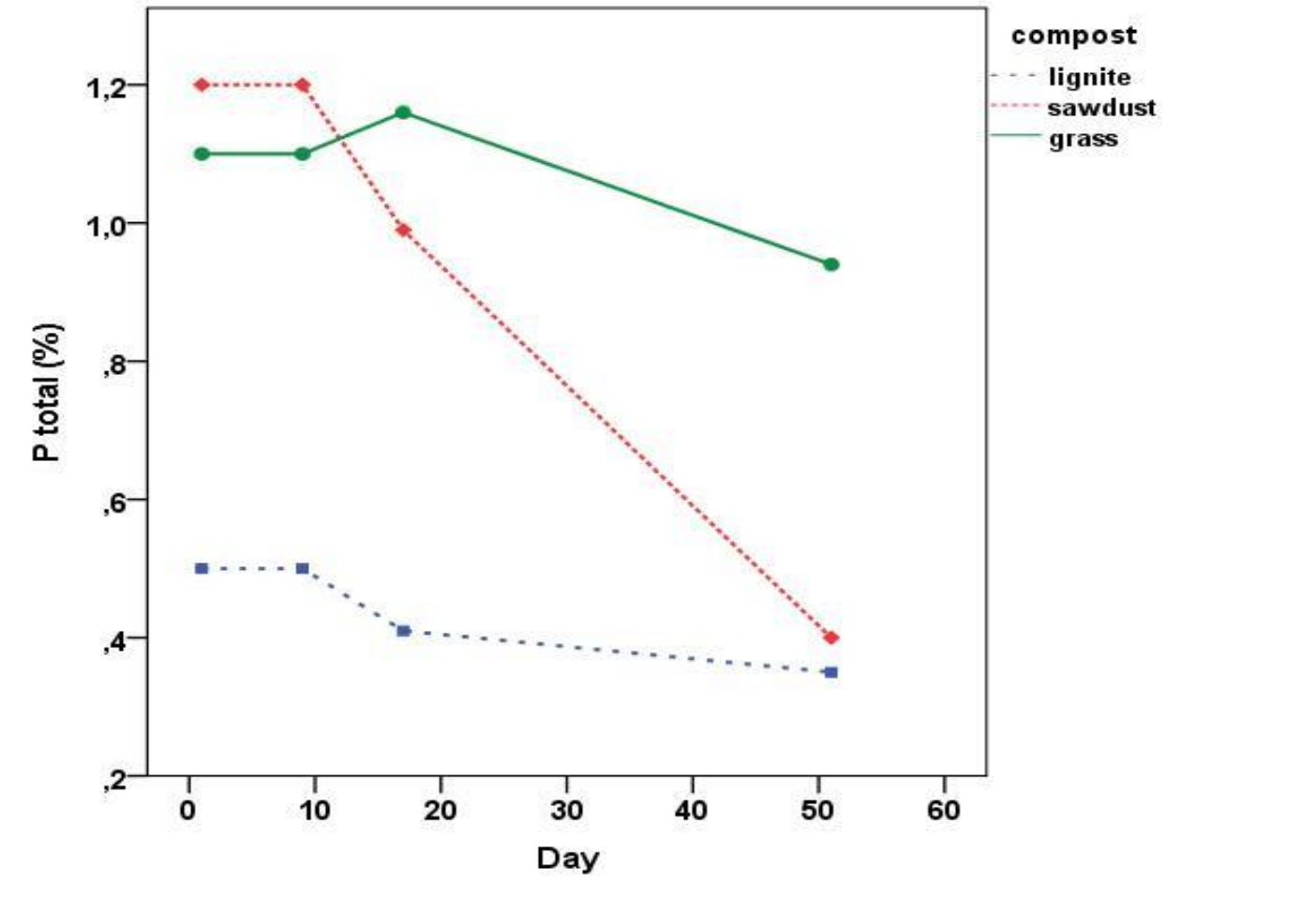


C/N ratio

- C/N ratio → stable at 10:1
  (during the whole process)

- According to bibliography initial optimum ratio 30:1

Total Phosphorus



Metals

Elements	Final compost (mg kg^{-1} DM)			*Legislative guidelines [a] (mg kg^{-1} DM)*
	Lignite	Sawdust	Dried grass	
Cd	0.14	<0.02	<0.02	*1*
Pb	7.5	8.9	7.6	*100*
Cr	110	56.3	52.7	*100*
Ni	377	60.3	32.5	*50*
As	43.3	3.1	3.2	*10*
Cu	56.2	54.0	74.5	*100*
Zn	93.5	35.6	126	*300*
Co	23.6	14.3	11.2	-
Mn	672	591	479	-
Fe	23800	19000	14800	-
Na	2980	3520	6710	-
K	6440	7040	8790	-
Ca	11600	17900	19800	-
Mg	11800	6630	5600	-

[a] : Commission Decisions 2006/799/EC and C(2006) 6982 (ECO Label to soil improvers and growing media, respectively

Microbiological quality

Pathogen	**Lignite**	**Sawdust**	**Dried grass**	***2006/799/EC***
E. coli (CFU g^{-1} dw)	483	1291	68	*1000*
Salmonella (CFU per 25 g dw)	absence	absence	absence	*absence*
Enterococci (CFU g^{-1} dw)	57	459	2411	-
Clostridia (CFU g^{-1} dw)	352	0	221	-

Conclusions

- ✓ Mixtures with dried grass and sawdust yielded composts of acceptable quality for specific uses, such as soil remediation
- ✓ Lignite was considered as an inappropriate bulking agent due to high metals concentrations measured in the final product
- ✓ The most promising, suitable and low cost bulking agent was the dried shredded grass
- ✓ Co-composting of brewery sludge with lower than optimum initial C/N ratios is feasible and allows the minimization of the required amount of bulking agent, if composting aims at solving the sludge disposal problem
- ✓ Final products were categorized as Class B. Characterization of Class A will be feasible, by constructing bigger piles and thus, achieving higher temperatures during composting

Thank you!!!