

UNIVERSITÀ DEGLI STUDI DI NAPOLI “FEDERICO II”



Scuola Politecnica e delle Scienze di Base

Dipartimento di Ingegneria Civile, Edile e Ambientale

**CORSO DI STUDIO MAGISTRALE IN
INGEGNERIA PER L'AMBIENTE E IL TERRITORIO
CLASSE DELLE LAUREE MAGISTALI IN INGEGNERIA PER L'AMBIENTE E IL TERRITORIO
(CLASSE LM35)**

TESI DI LAUREA

**“OTTIMIZZAZIONE IMPIANTISTICA DEI PROCESSI DI BIOAUGMENTATION
FINALIZZATI ALLA VALORIZZAZIONE ENERGETICA DI BIOMASSA DI SCARTO A MATRICE LIGNOCELLULOSICA:
INDAGINE SPERIMENTALE A SCALA SEMI-PILOTA”**

Relatore

Ch.mo Prof. Ing. Massimiliano Fabbicino

Candidato

Elena Bianco

Matricola M67/283

Correlatore

Ing. Dott. Alberto Ferraro

Anno Accademico 2015/2016

Idrolisi



Batteri
idrolitici

Acidogenesi



Batteri
acidogeni

Acetogenesi

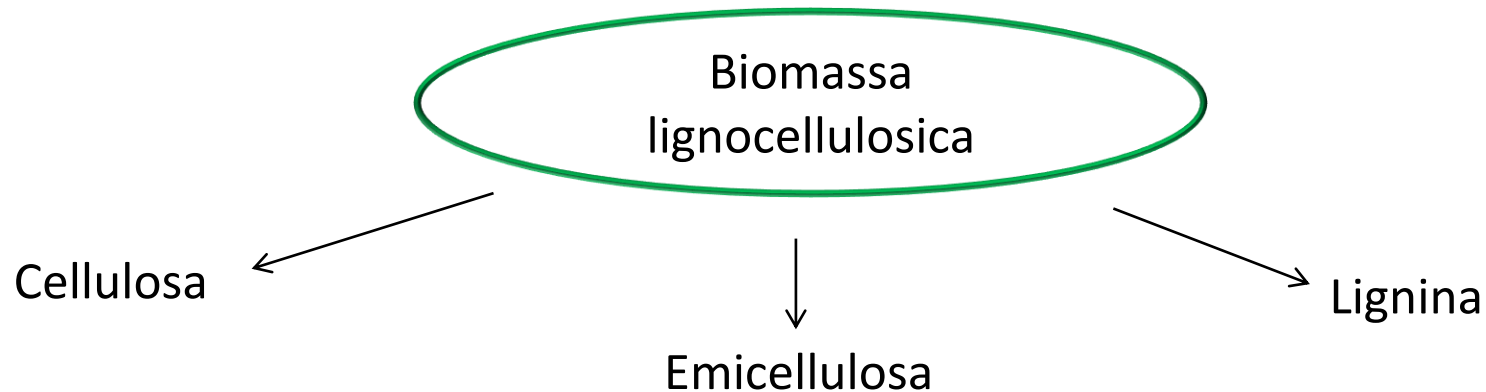


Batteri
acetogeni

Metanogenesi

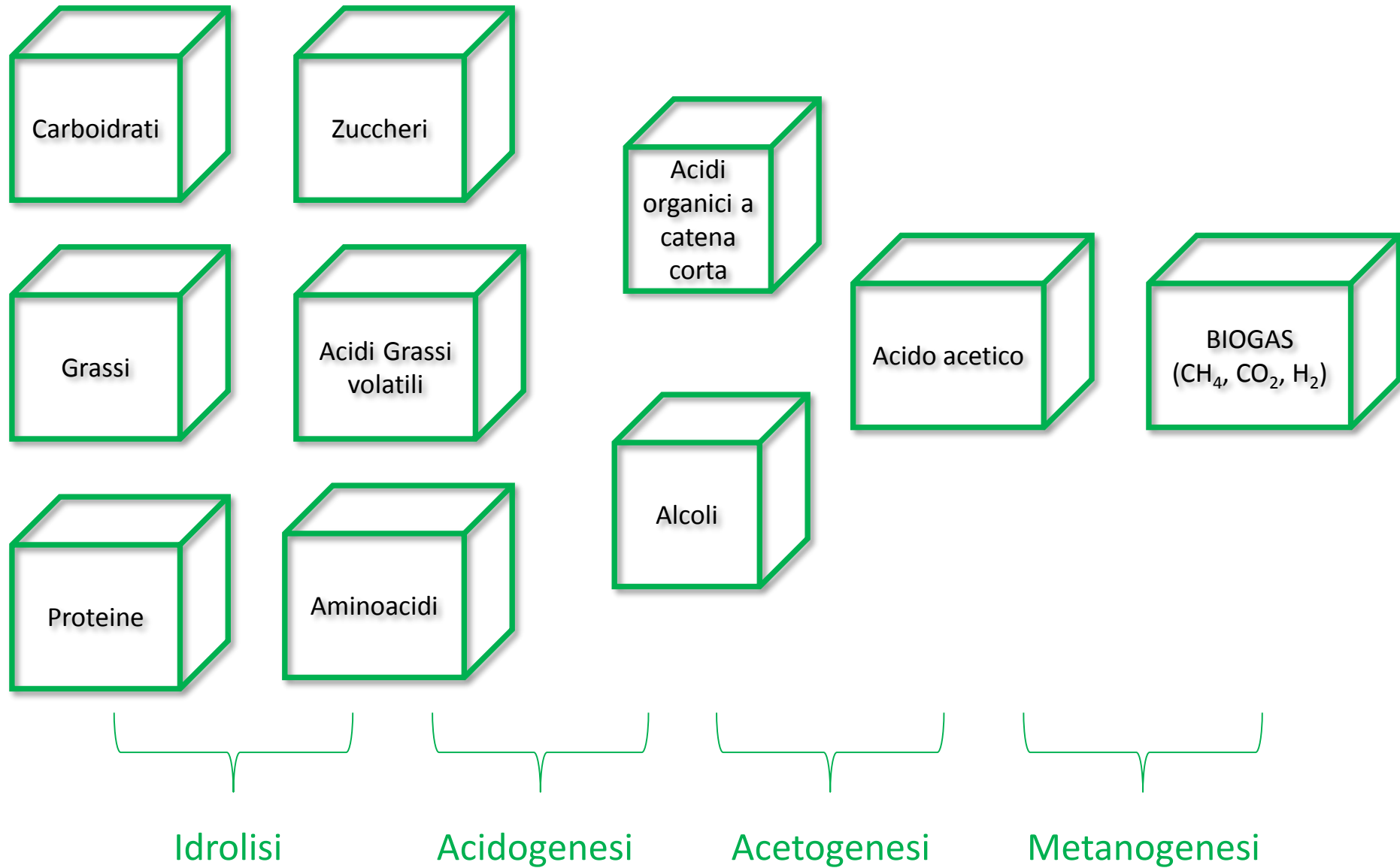


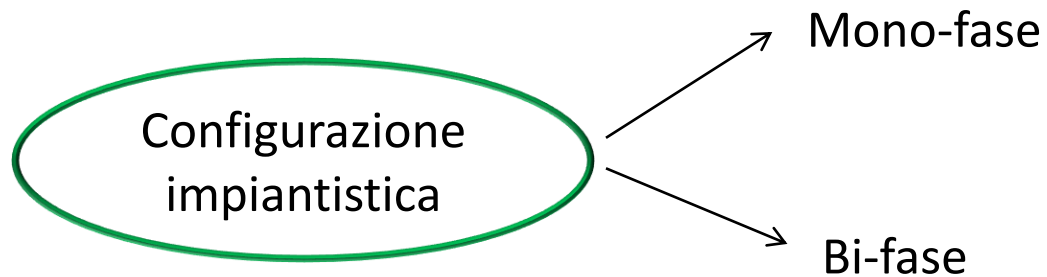
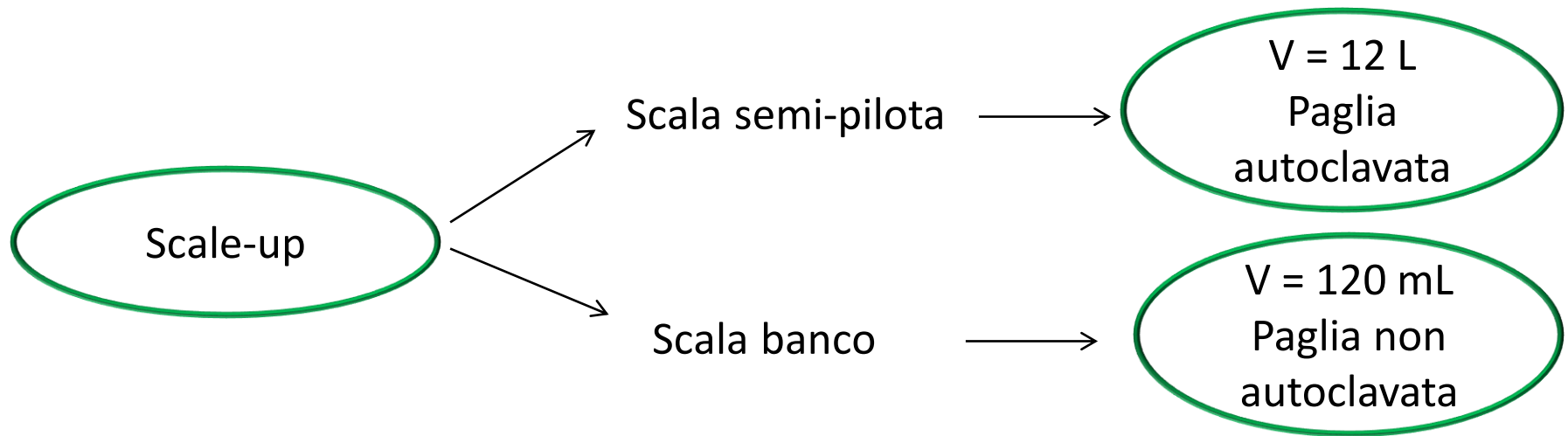
Batteri
metanigeni

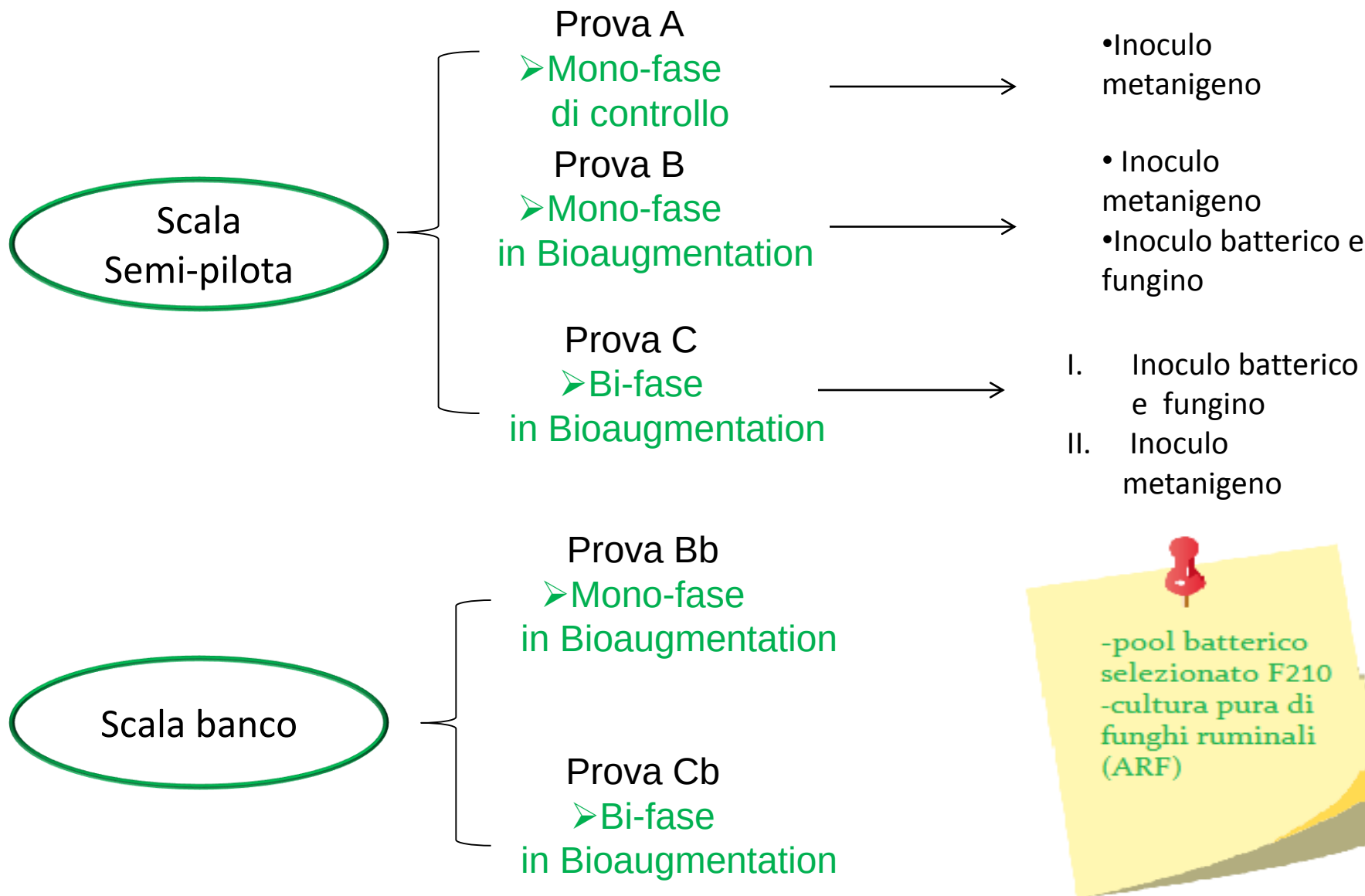


Biomassa	Ceneri(%)	Emicellulosa (%)	Cellulosa(%)	Lignina(%)
Gambi di mais	3	26	38	11
Paglia di grano	1,3	27,6	34	18
Paglia di riso	18,9	22,7	37	13,6
Paglia di avena	2,6	24,9	37,1	15,4
Paglia di segale	1,2	25,7	37,1	17,6
Paglia di orzo	7,1	44	37	11

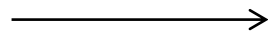
Digestione Anaerobica







- Condizioni mesofile

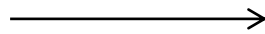


$T = 35^{\circ} \text{C}$

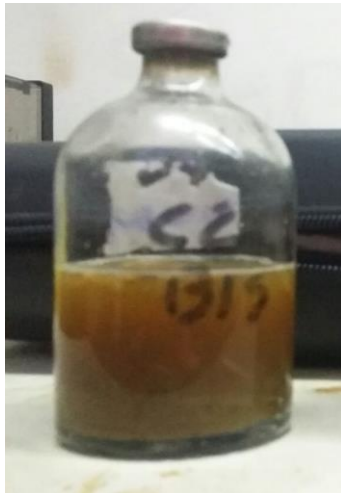
- Condizioni anaerobiche



- Tampone fosfato



$\text{pH} = 6,9 \pm 0,1$



$h = 10 \text{ cm}$
 $V = 120 \text{ ml}$



$h = 41 \text{ cm}$
 $V = 12000 \text{ ml}$



8 g SV/L

ST = 92%
SV = 84,2%

Solidi totali

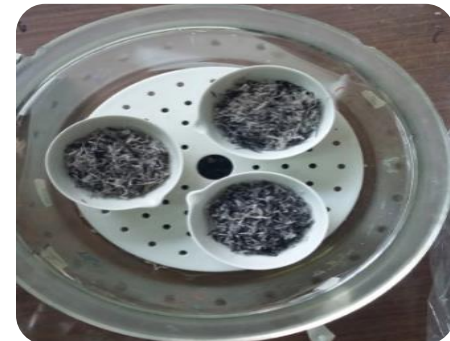
Solidi volatili

Residuo secco

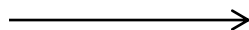
PRIMA



DOPO



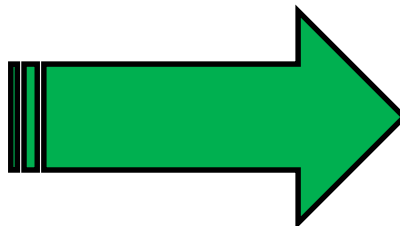
Misurazione
del gas



Frequenza (h)	Giorni
12	1-5
24	6-22
48	23-39



Gascromatografia



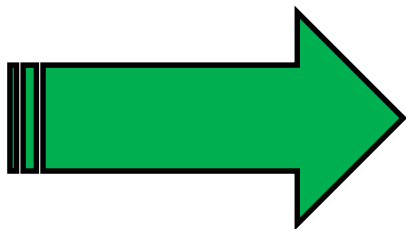
Misurazione
 H_2S



Metodo colorimetrico

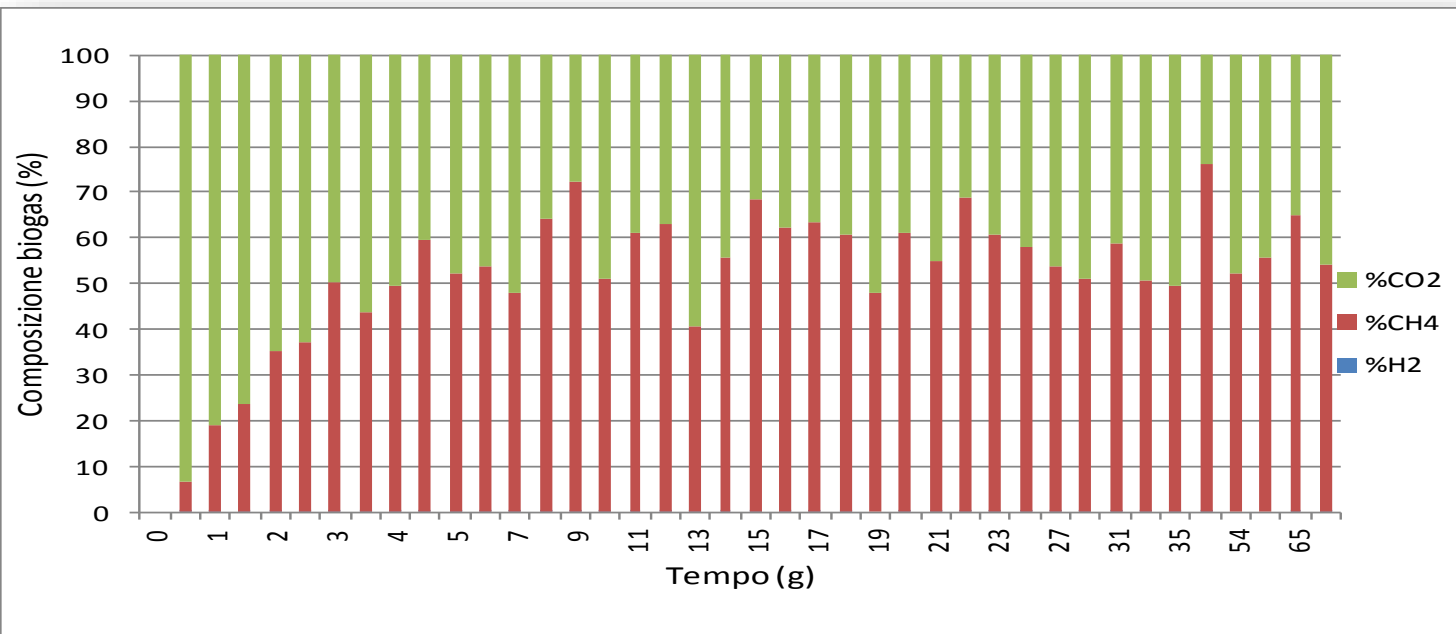


Analisi VFA

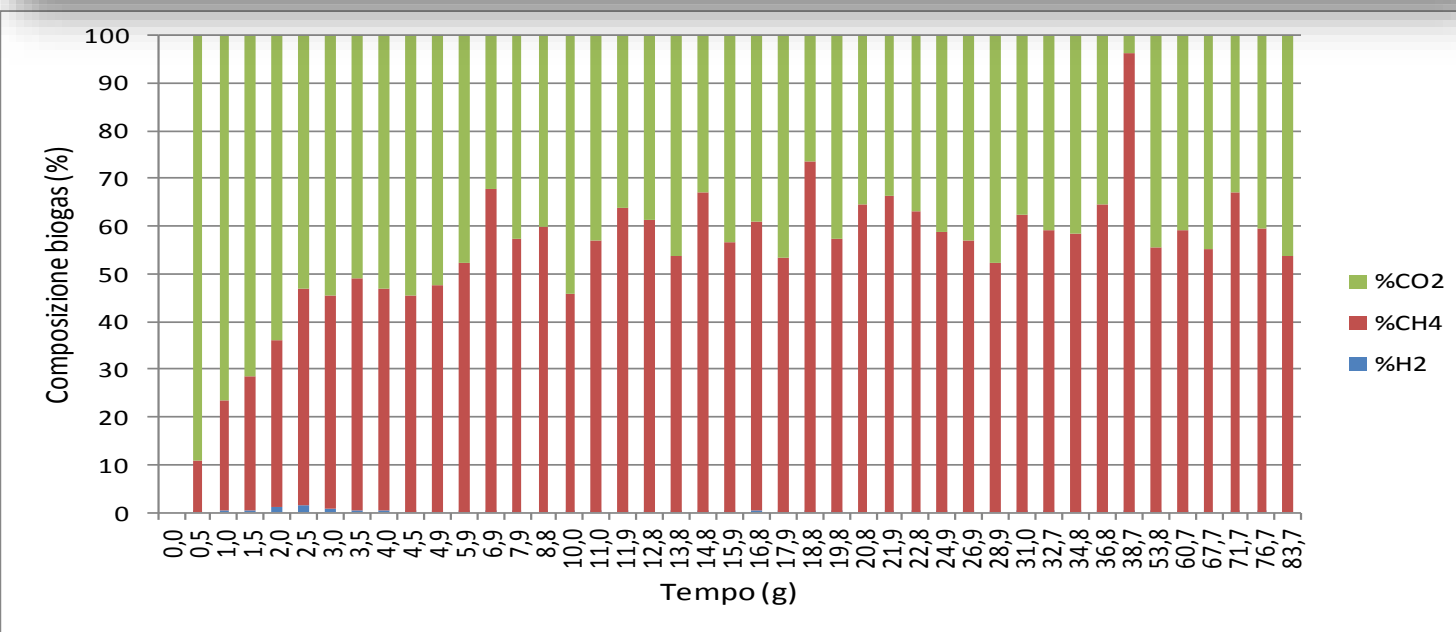


Gas Cromatografia ad elevata prestazione (HPLC)

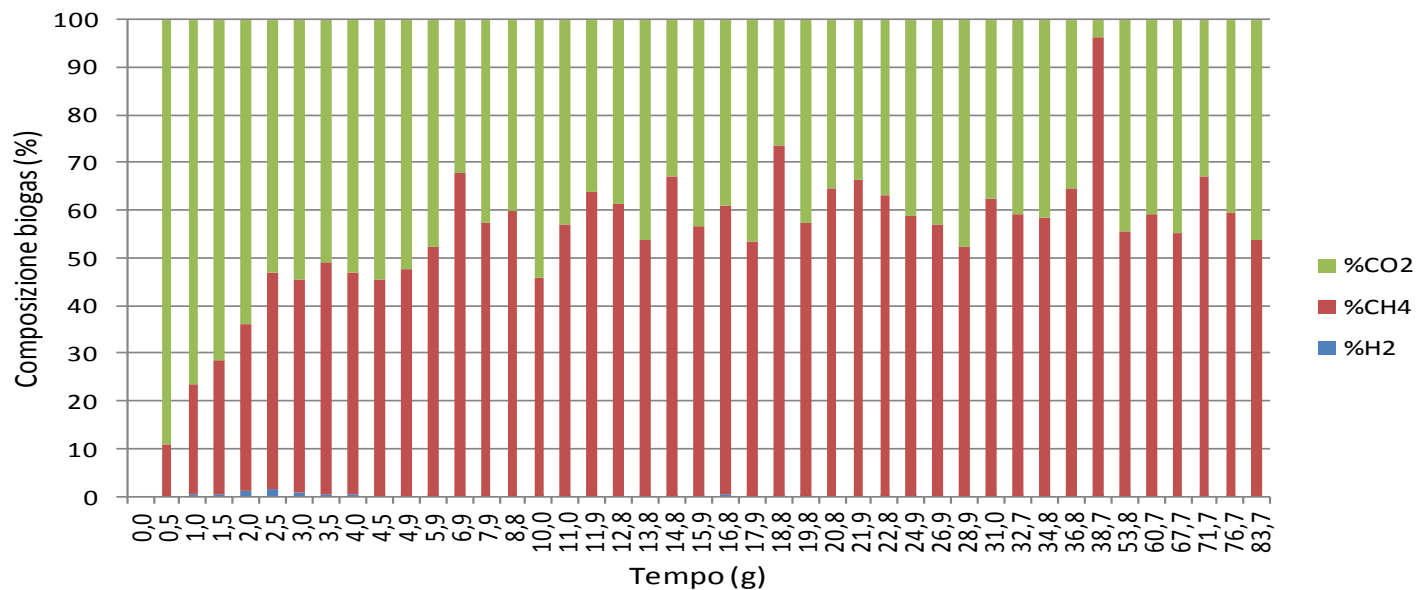




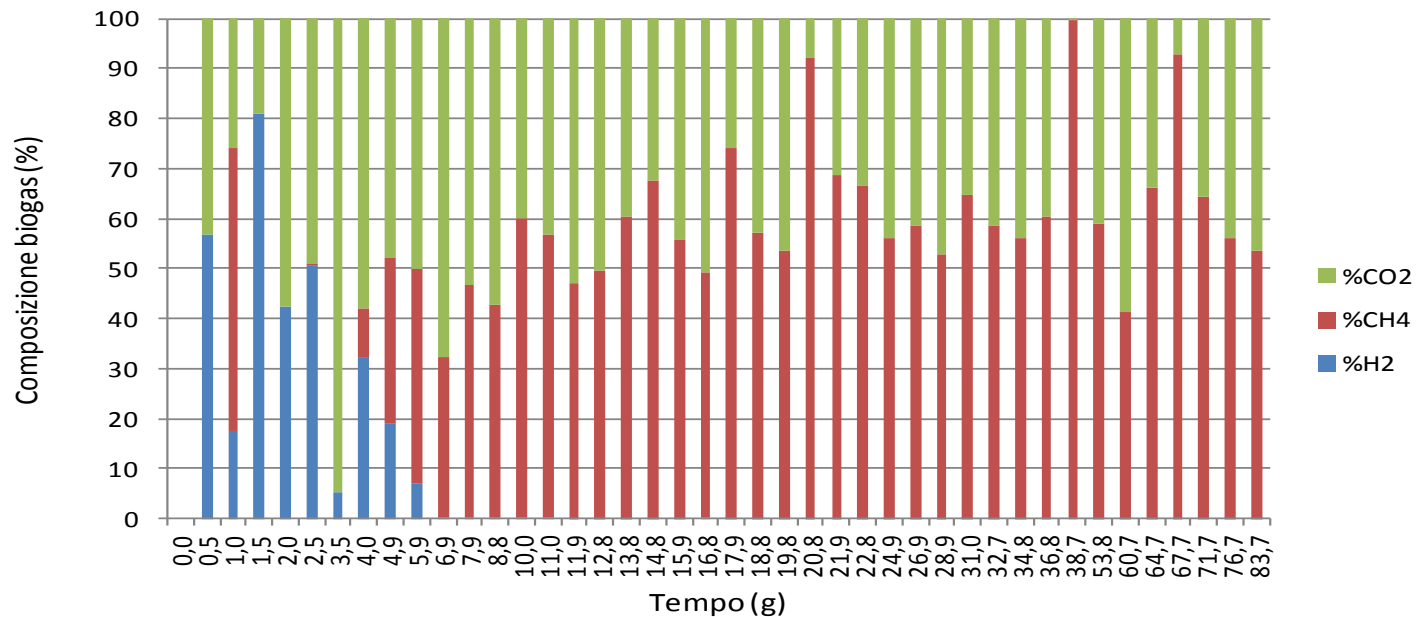
Mono-fase
(controllo)



Mono-fase
(Bioaugmentation)

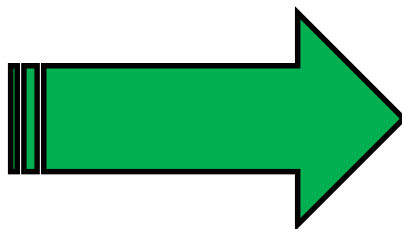


Mono-phase
(Bioaugmentation)



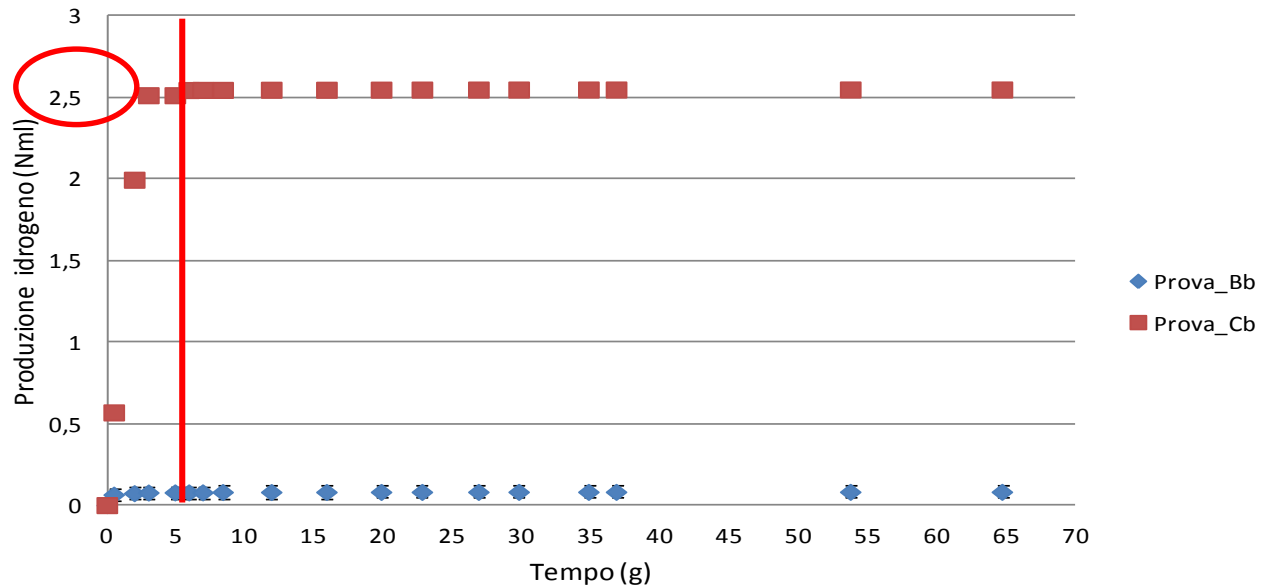
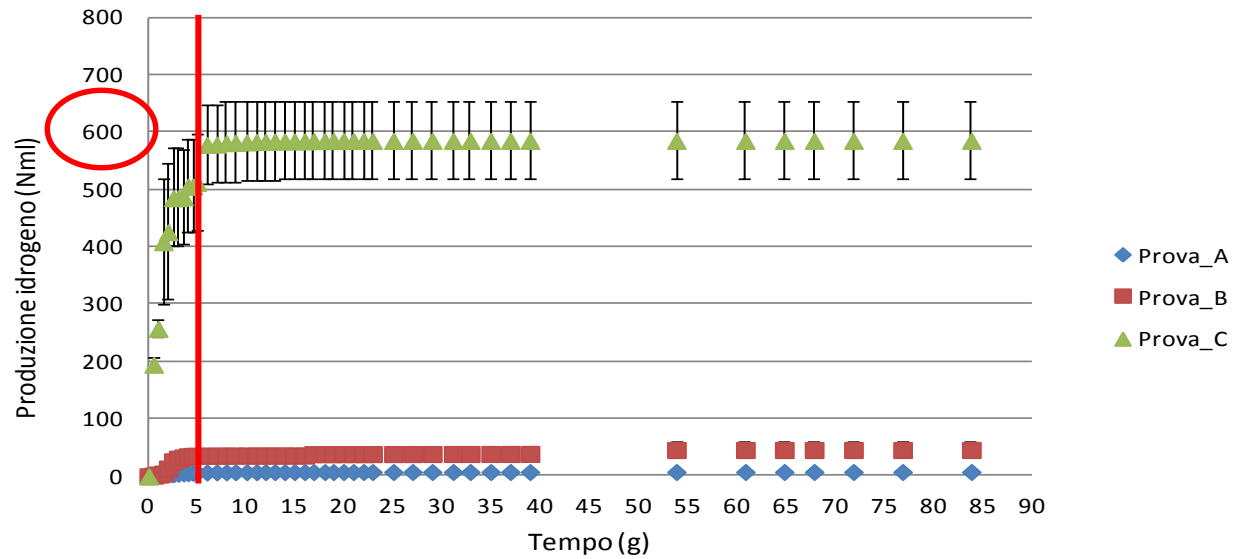
Bi-phase
(Bioaugmentation)

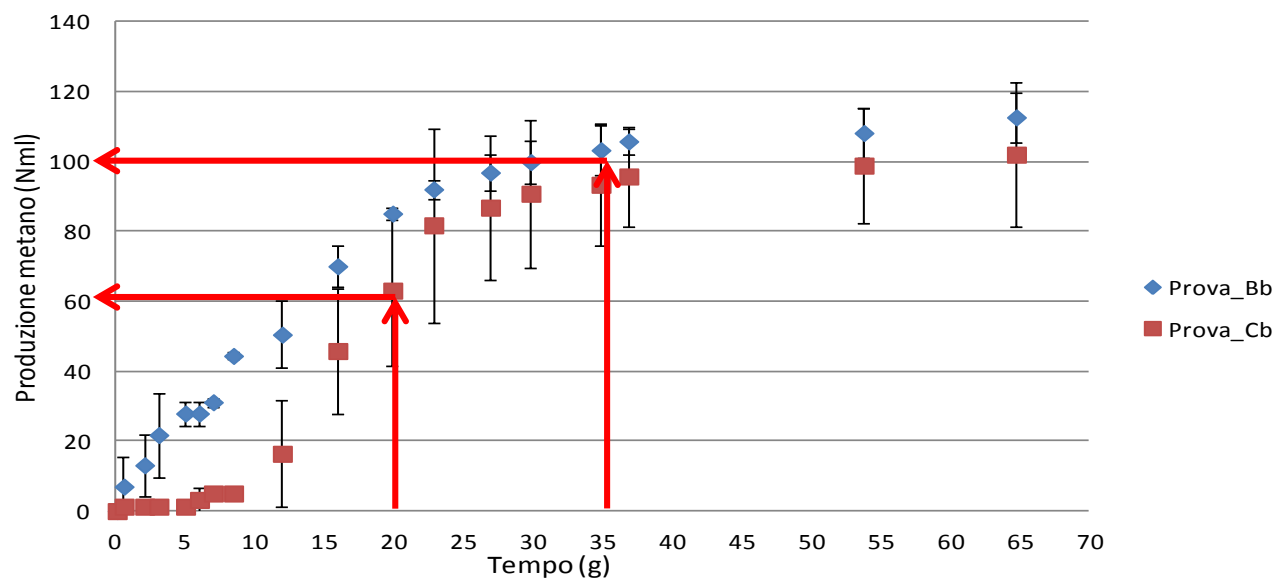
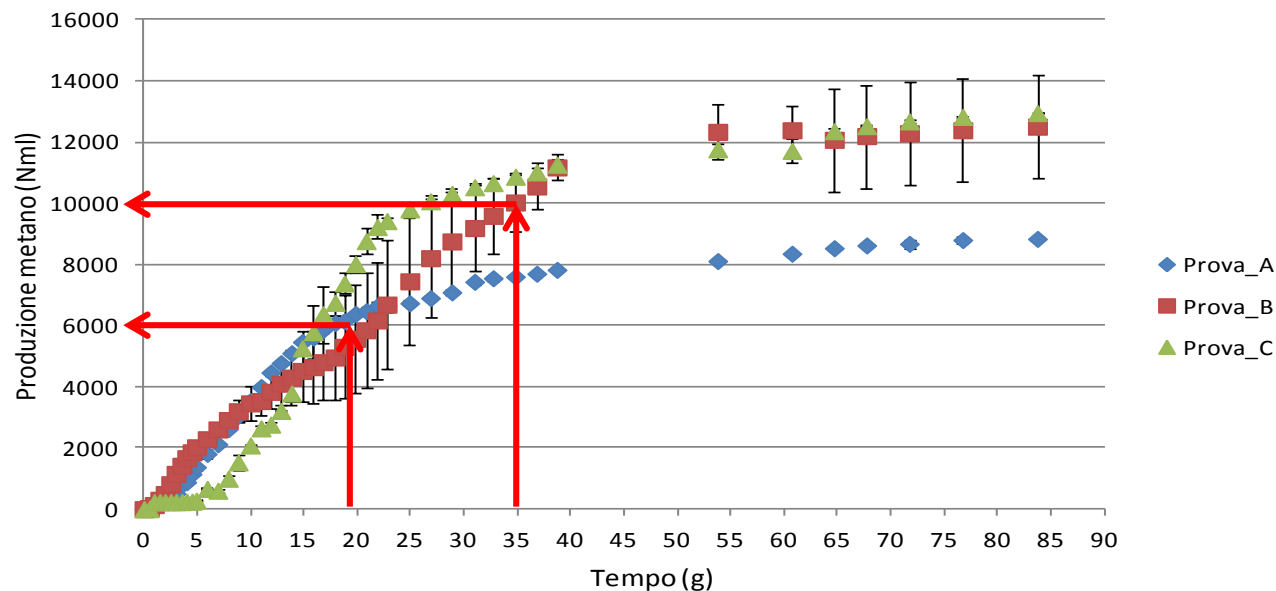
Misurazione
gas



Misurazione
 H_2S

Prova	H_2S (%)
A	< 0,1
B	0,1-0,2
C	0,1-0,15

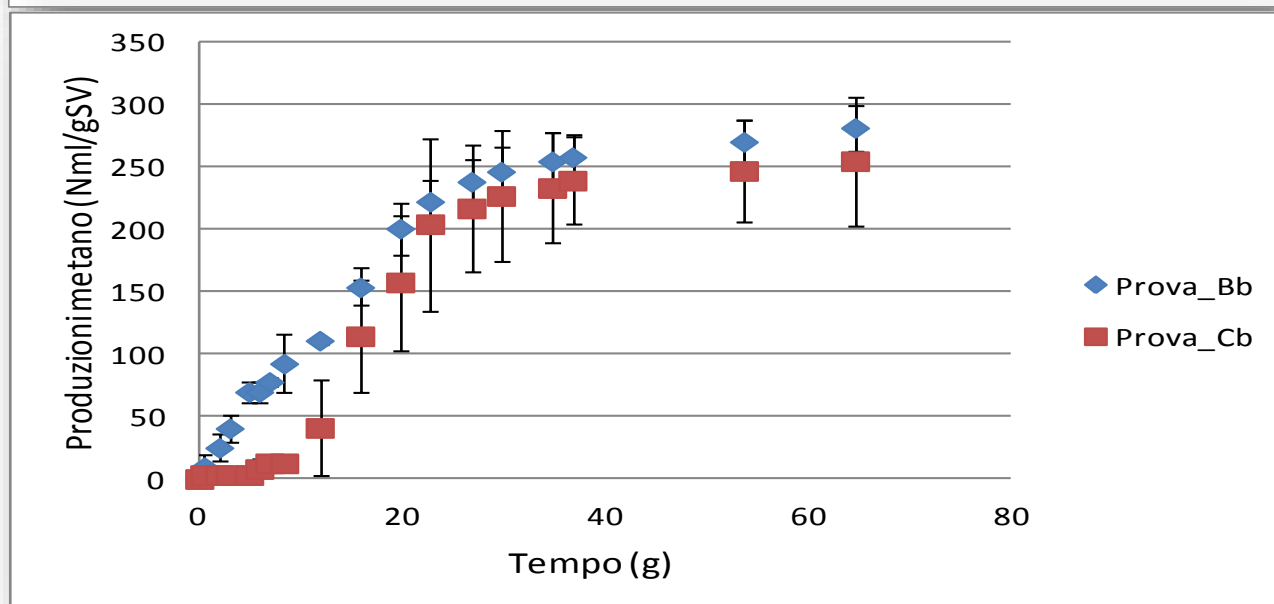
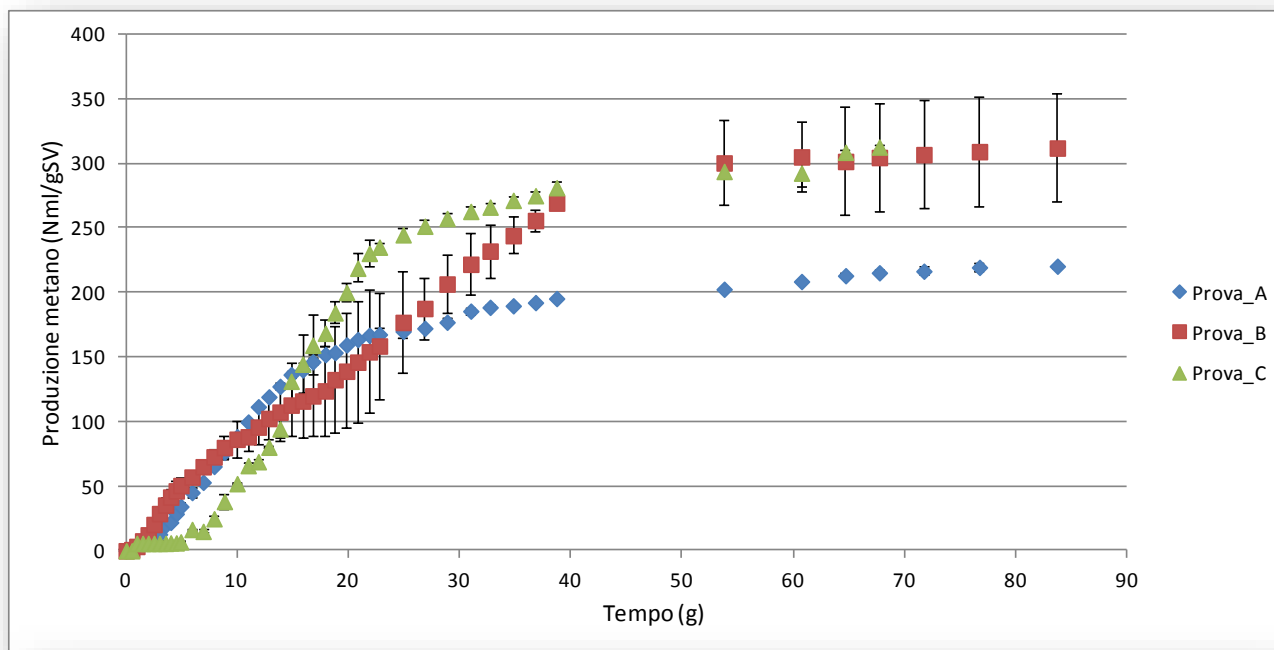


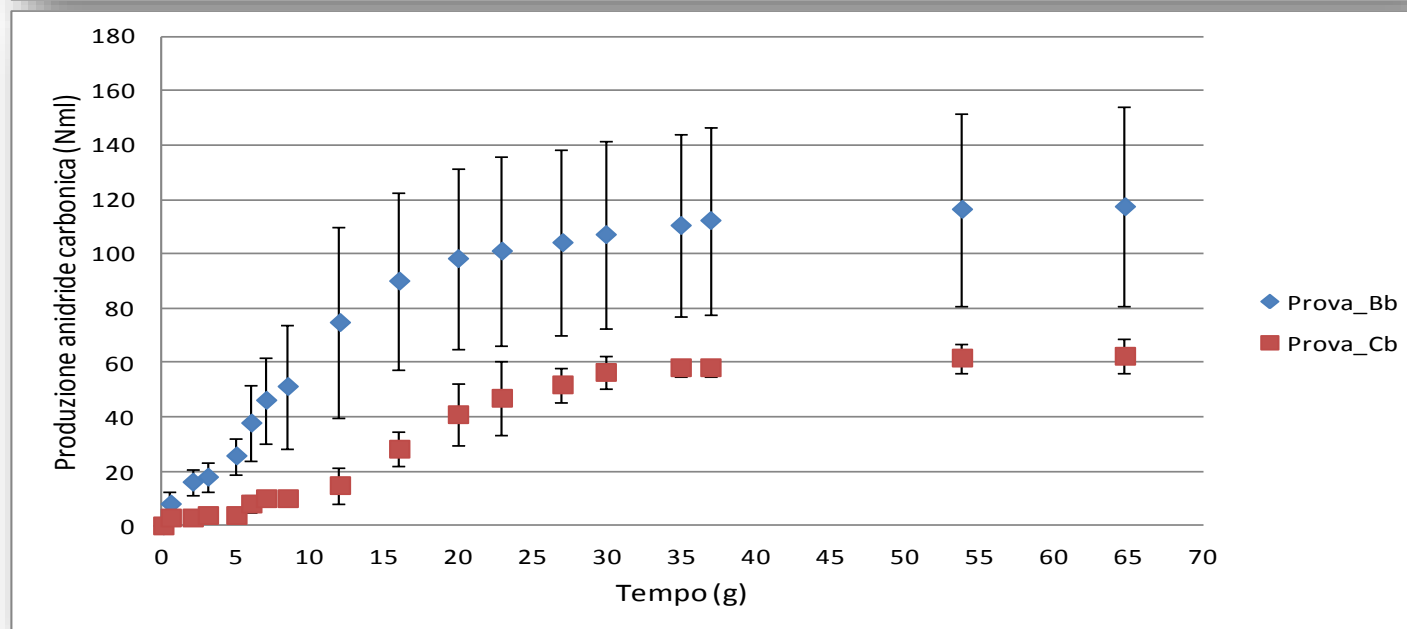
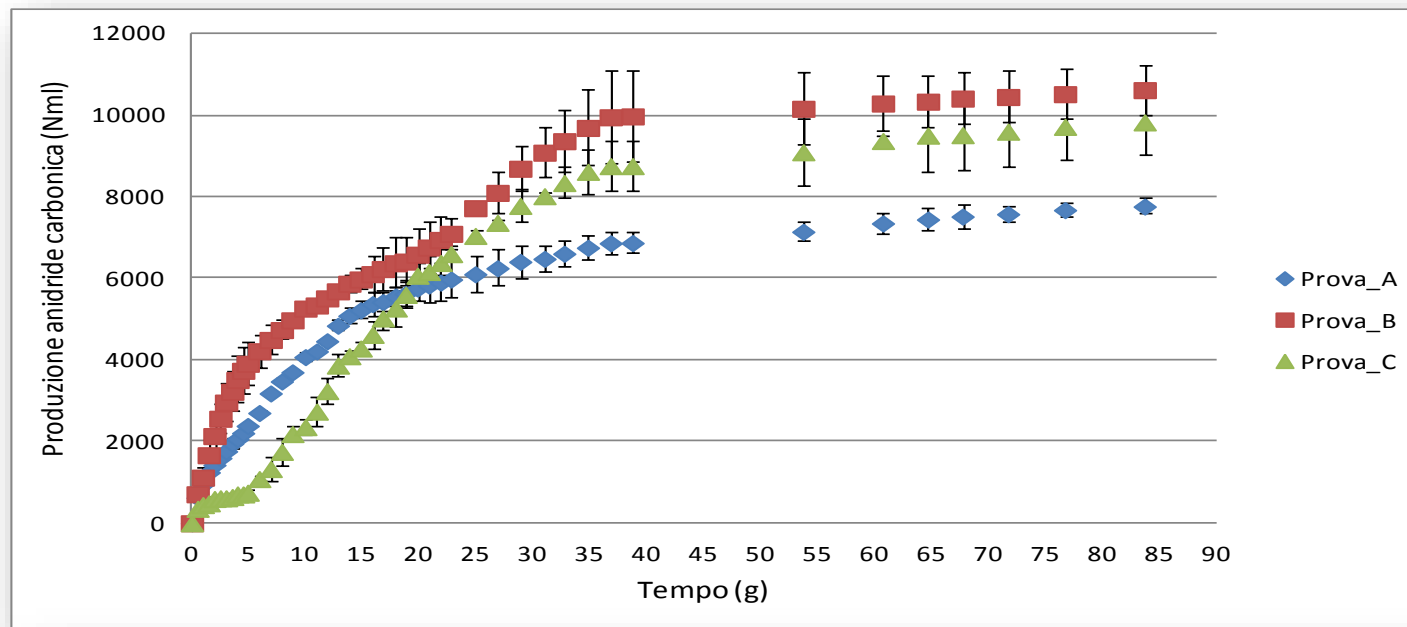


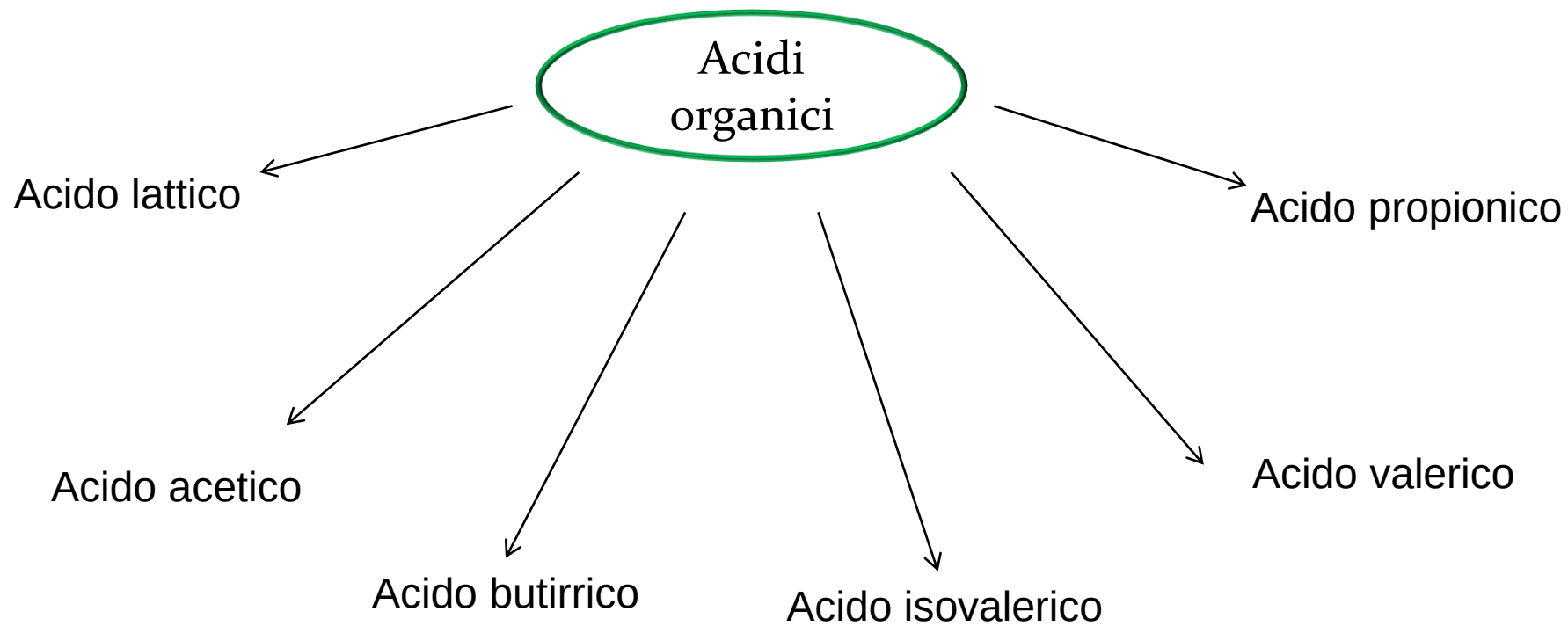
Fattore
di scala
100

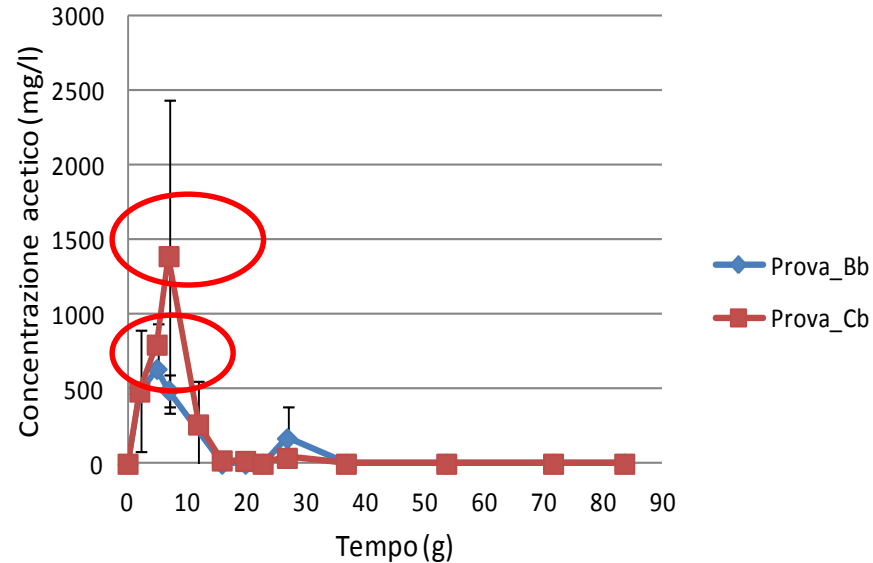
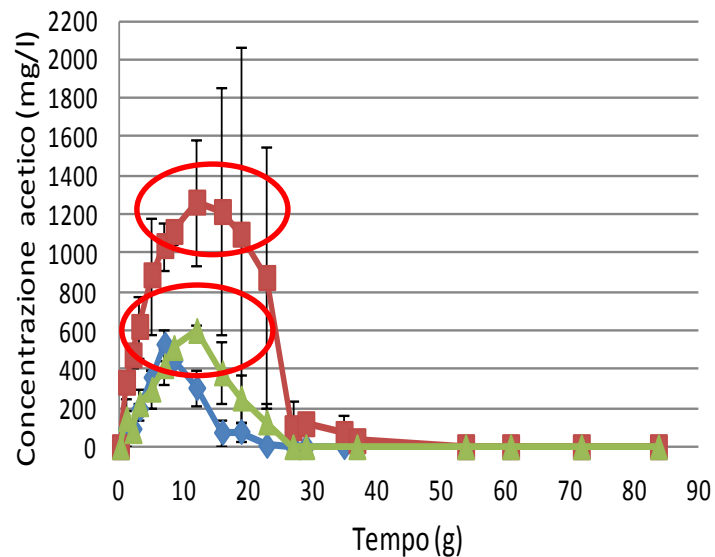
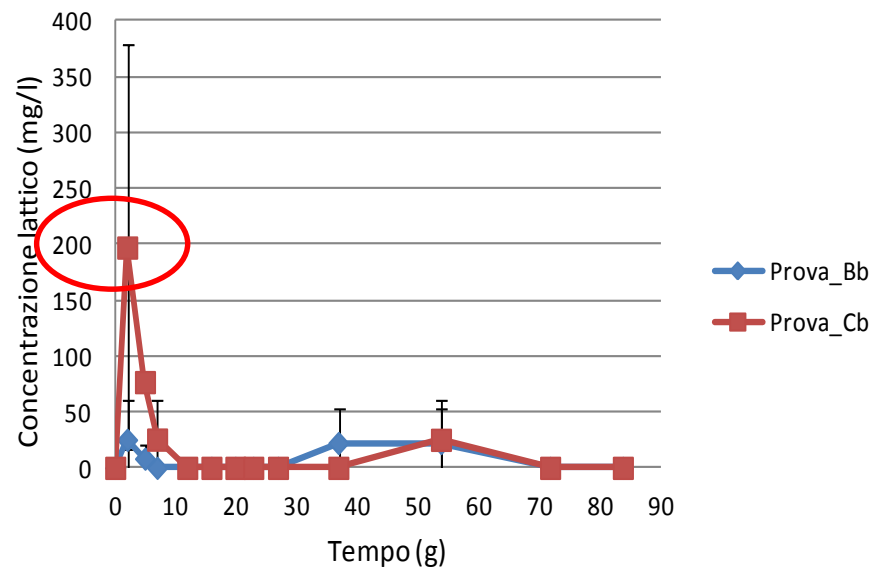
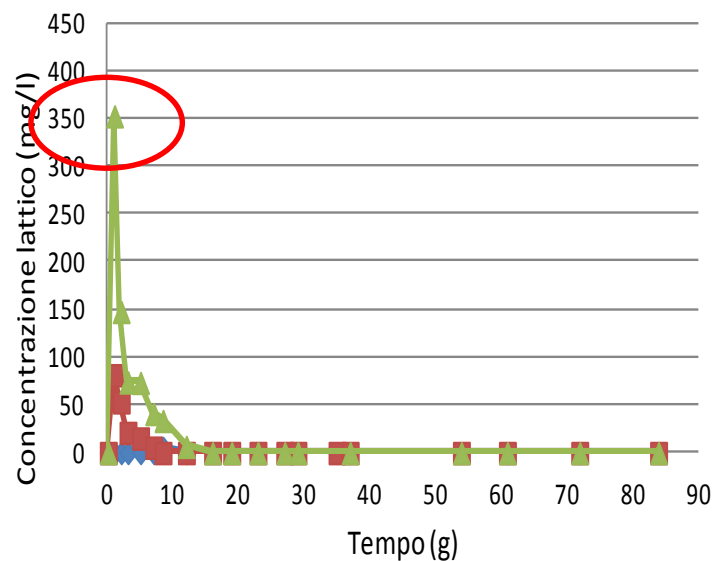
Rapporto
dei
volumi
100

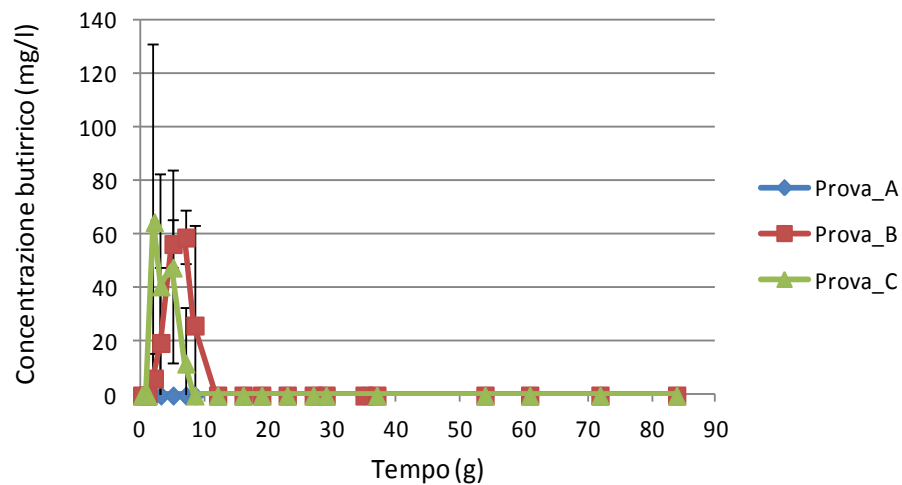
Risultati



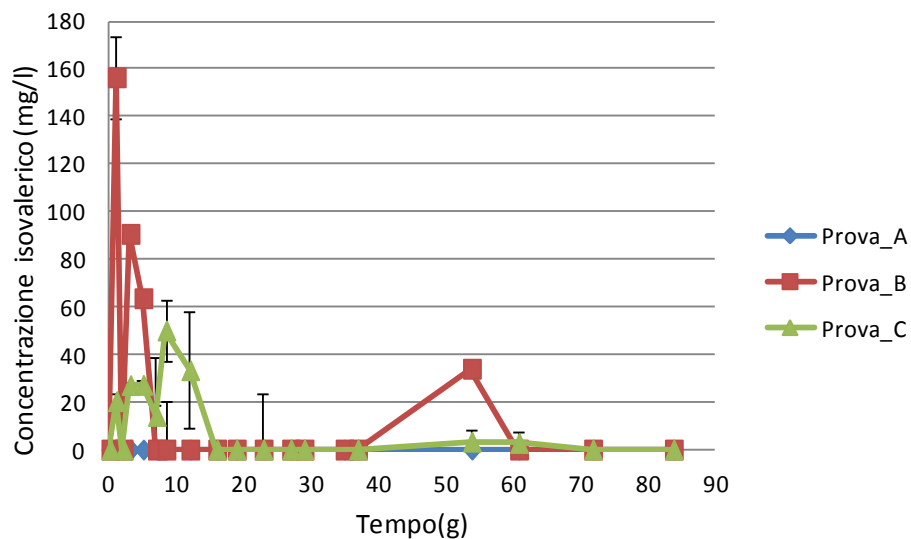




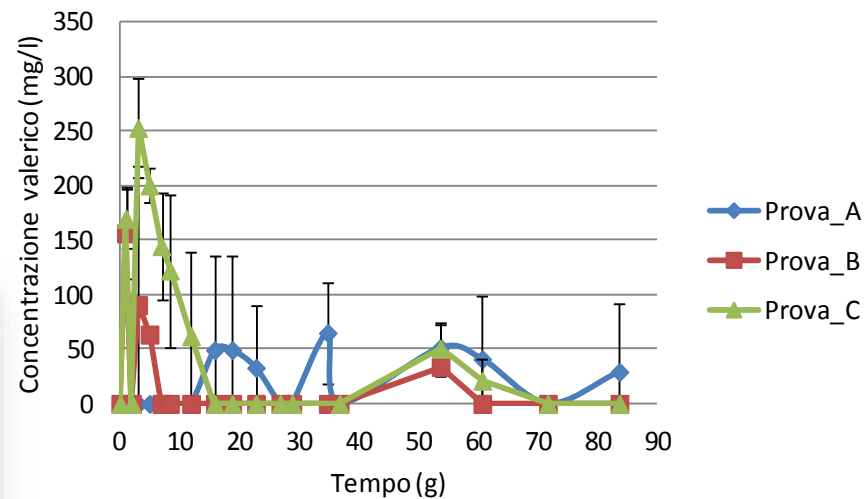




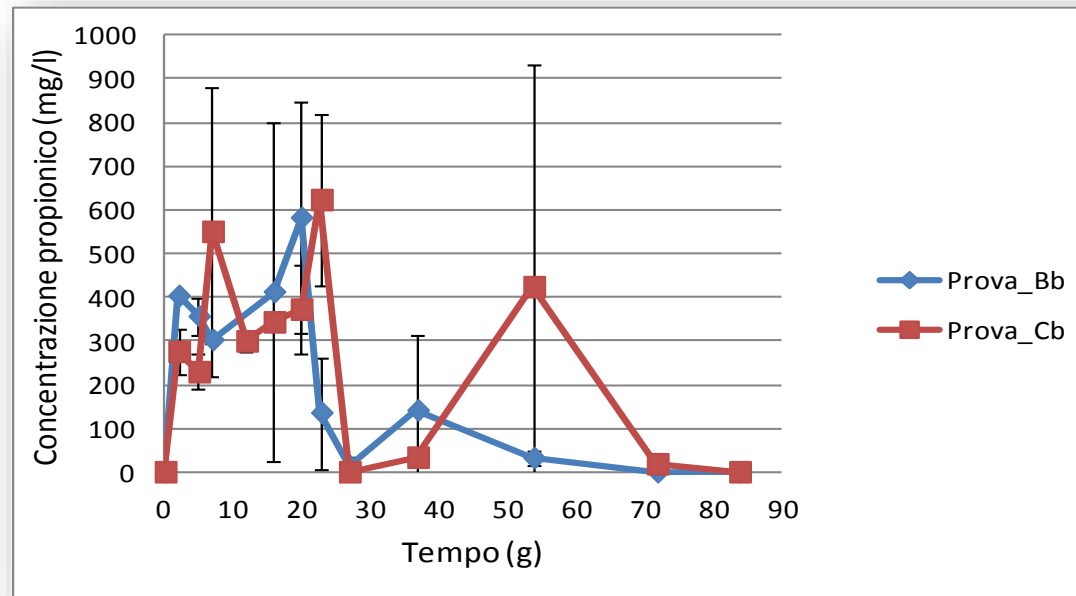
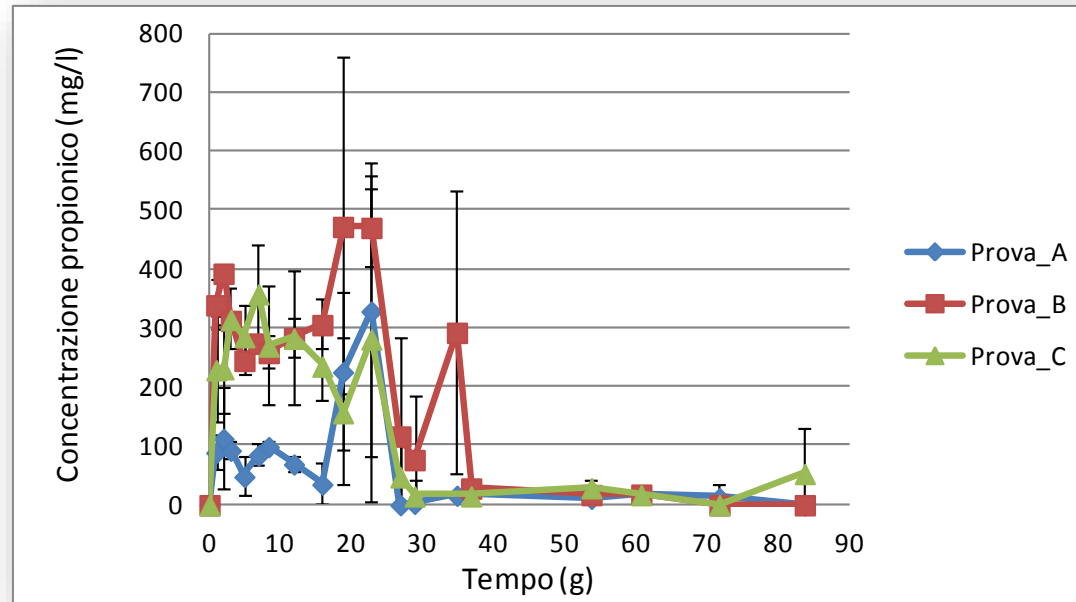
Acido butirrico

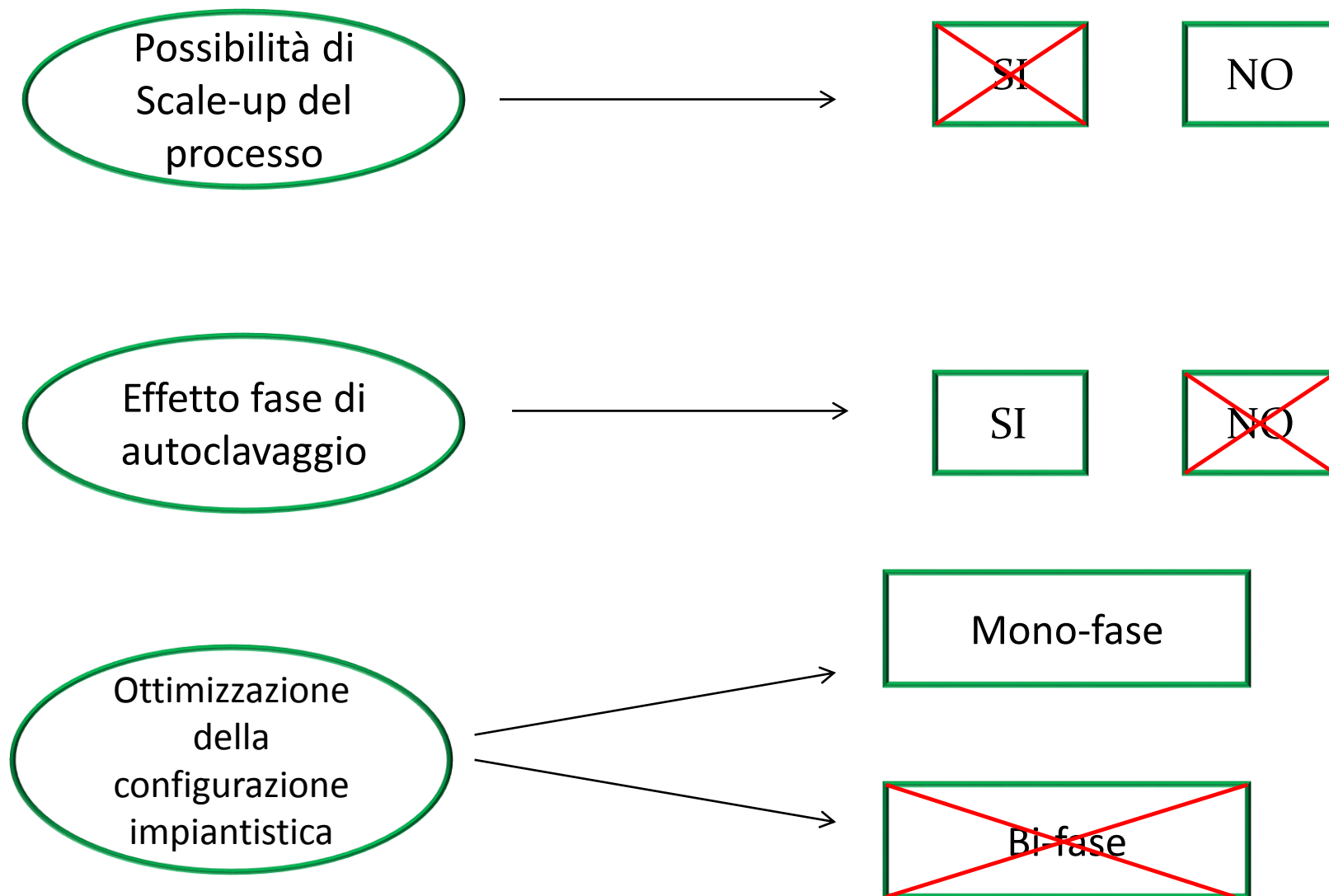


Acido isovalerico



Acido valerico





Sulla base dei risultati ottenuti si propone...

- Ulteriore scale up del processo e validazione del modello su impianti a scala reale;
- Sviluppo di analoghe prove utilizzando un differente substrato a matrice lignocellulosica per effettuarne un confronto in termini di rese di biogas;
- Parallelismo con analoghe prove che prendano in considerazione un pretrattamento chimico e termico.

Grazie per l'attenzione