EFFECT OF BONE DURING FIXED BED PYROLYSIS OF BIOMASS

BY

MOHAMMED ALHASSAN AND JOHN ANDRESEN

CHEMICAL AND ENVIRONMENTAL ENGINGINEERING DEPARTMENT

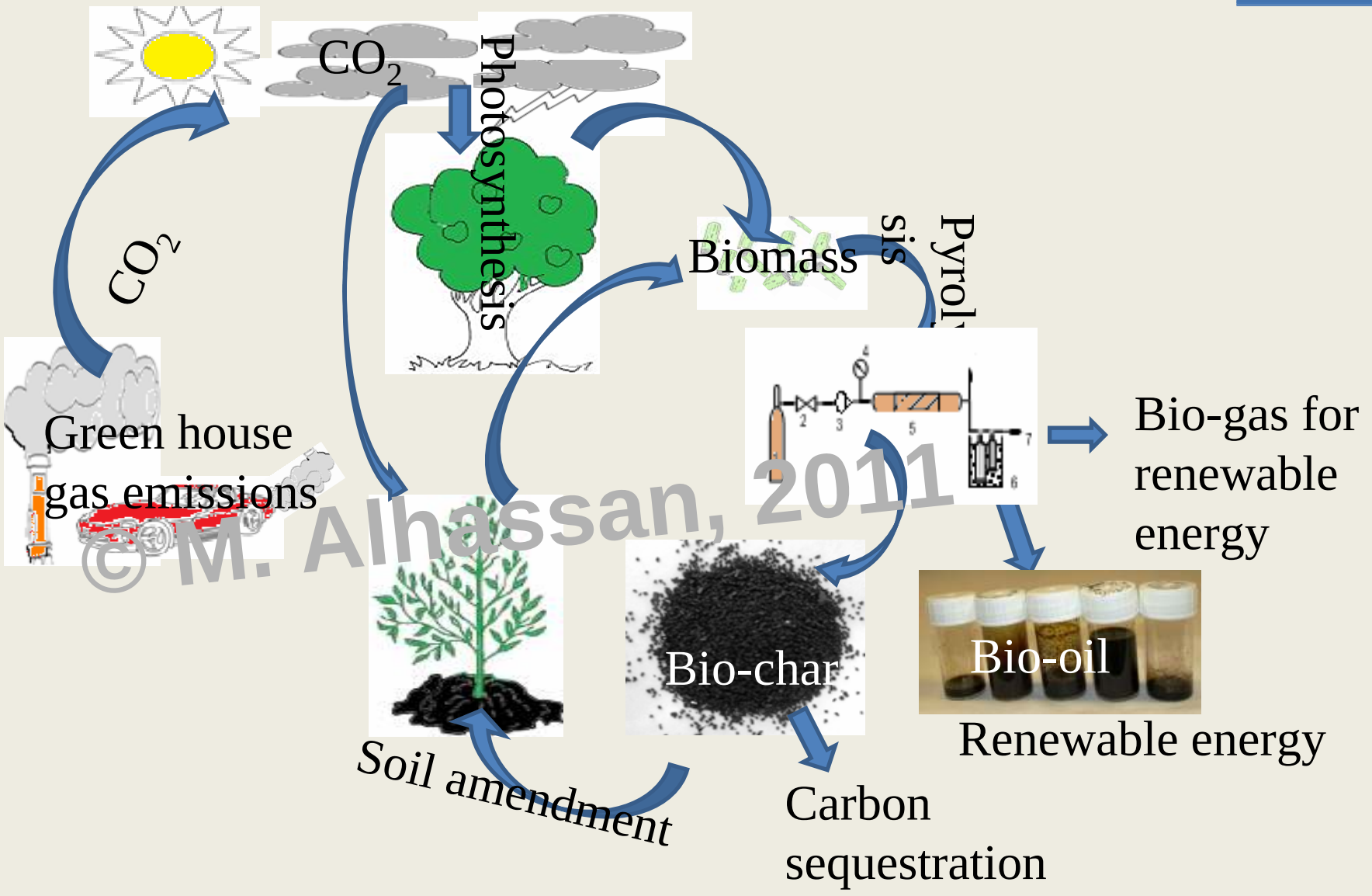
UNIVERSITY OF NOTTINGHAM

WHY BONE?

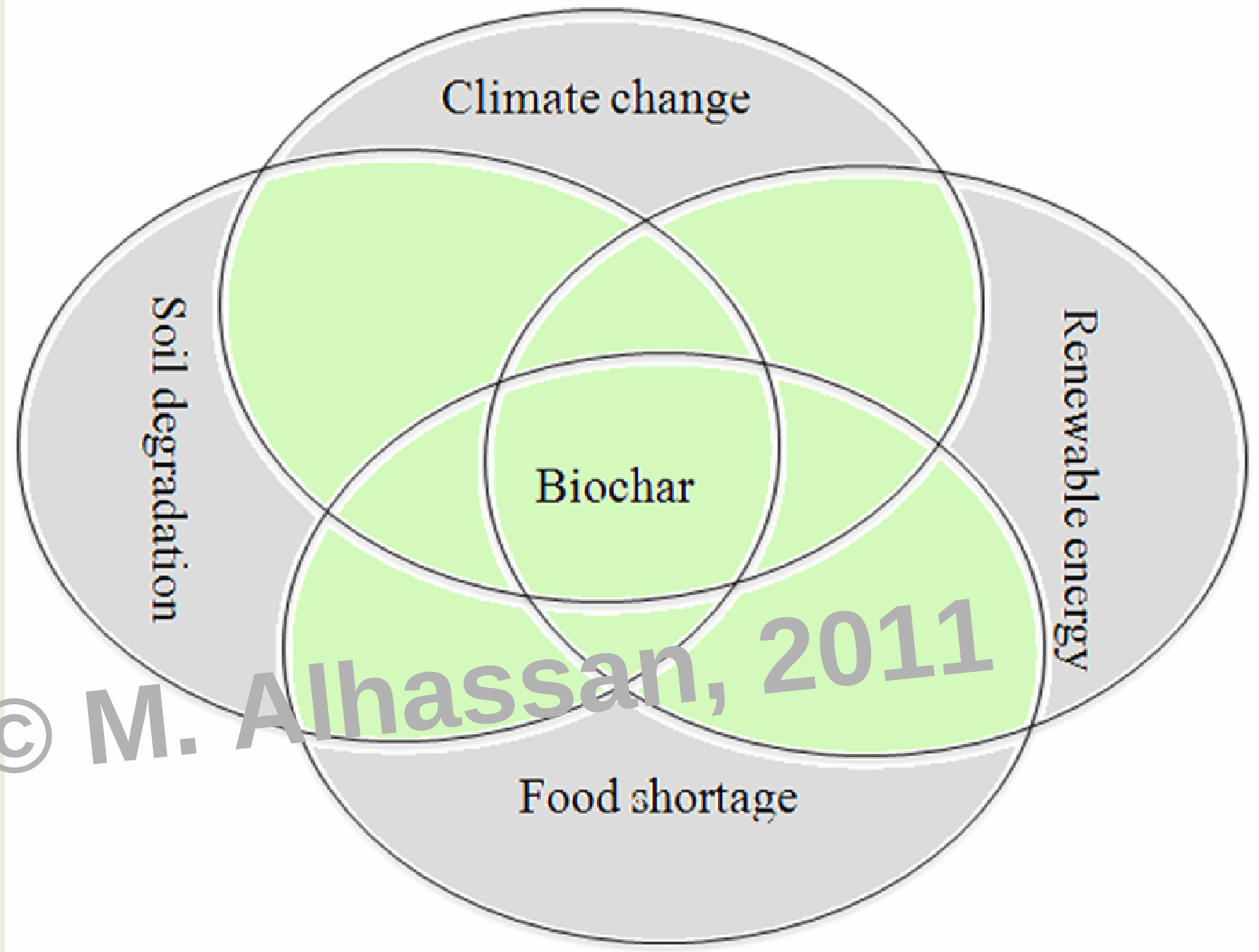
- Availability as waste
- Its elemental components (Na, K, Ca etc)
- Its nitrogen content (for soil amendment)
- Tailored bio-char structure such as terra-preta

AIM AND OBJECTIVES

➢To develop an integrated system for a combined production of bio-char for CCS, soil amendment and co-produce bio-oil for renewable energy production.



BIOCHAR: AN INTEGRATED SOLUTION



CHALLENGES:

Biomass + Bone:

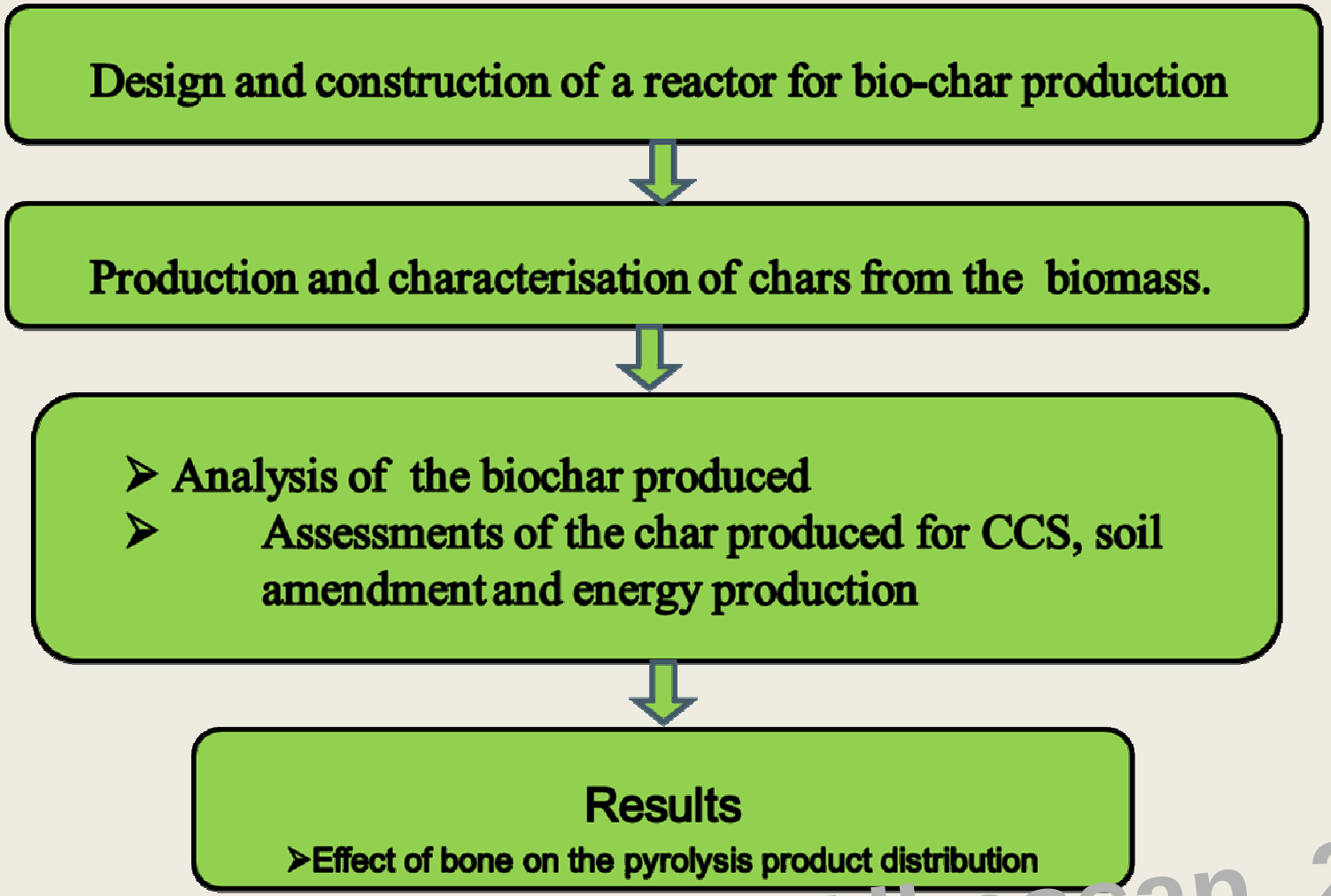
Optimum char yield

Soil amendment

Bio-oil quality

METHODOLOGY

➢OVERVIEW OF THE EXPERIMENTAL TASKS



MATERIALS

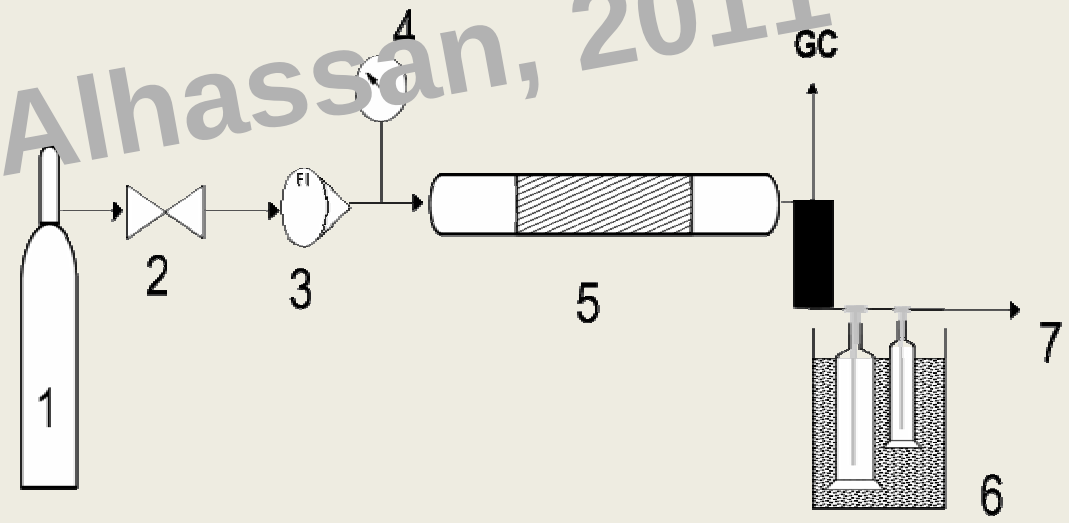
- Biochar made at low temperatures from (wood, Pistachio, straw) with and without bone added.

PROCESS

1)Mix biomass and bone

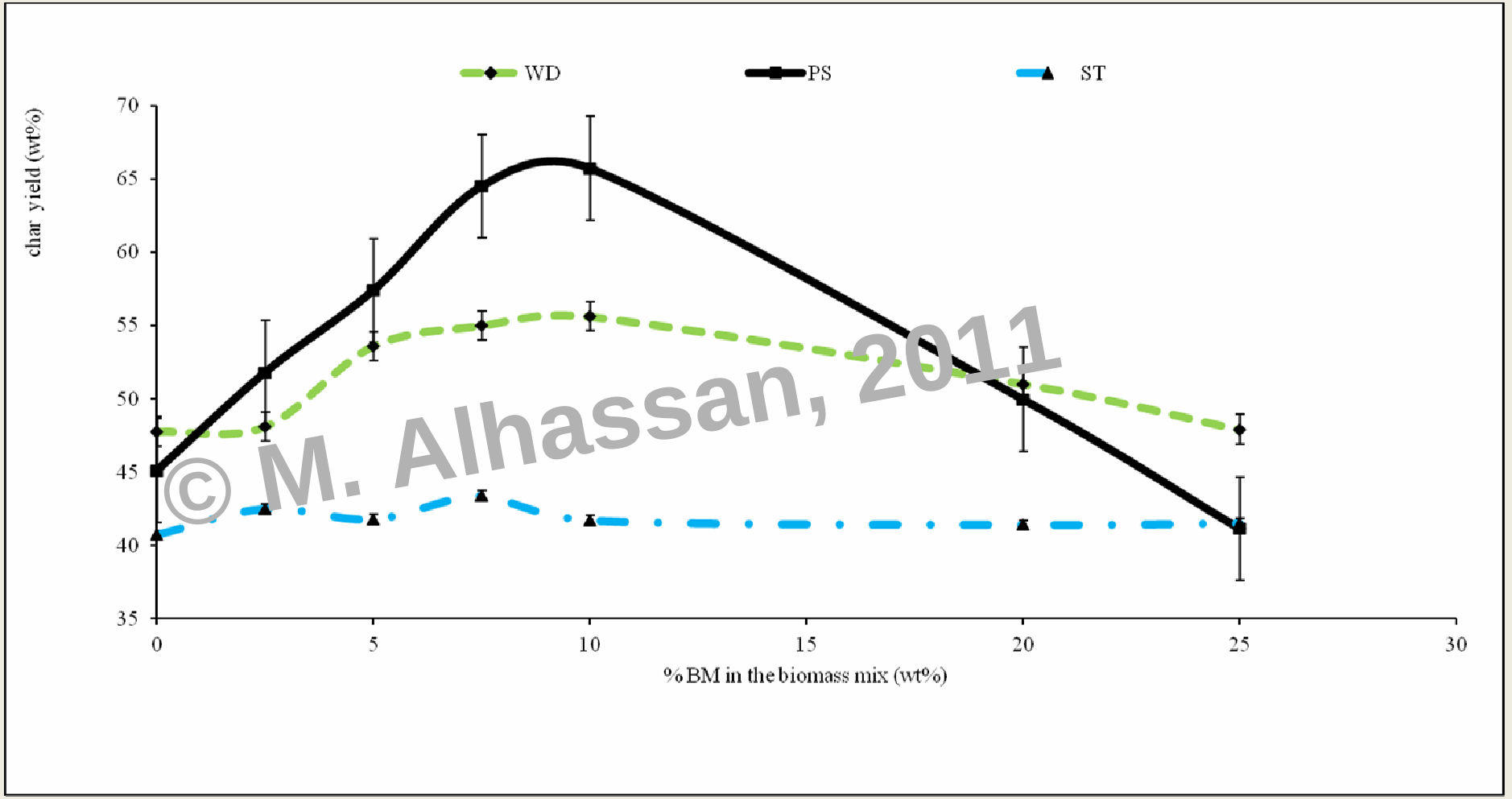
2)Place the mixed material into the fixed bed reactor and heat up to the desired temperature. Hold this temperature for 1 hour or more.

EXPERIMENTAL SETUP

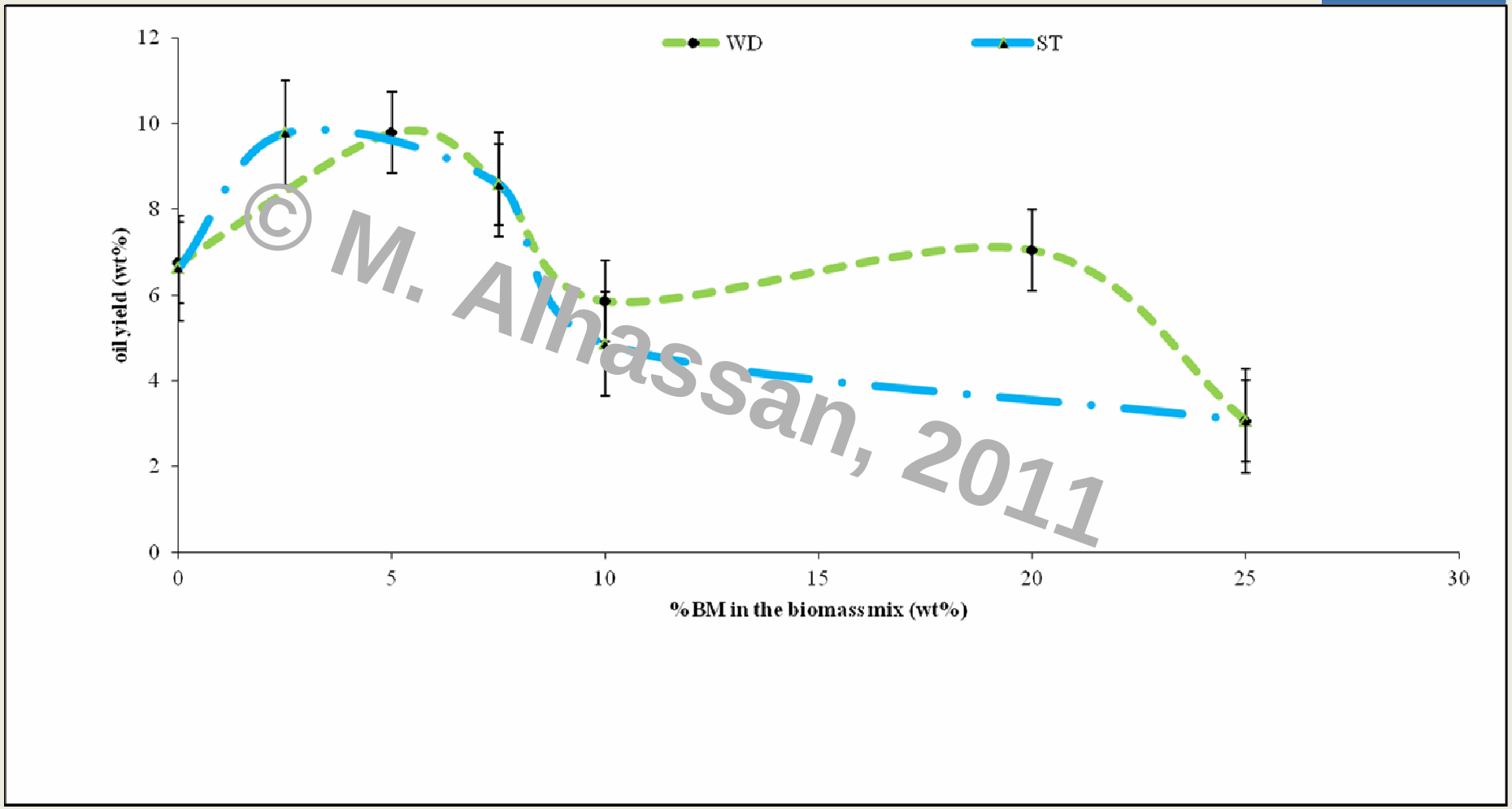


1. N_2 cylinder
2. Valve
3. Flow meter
4. Pressure gauge
5. Reactor
6. Tar trap

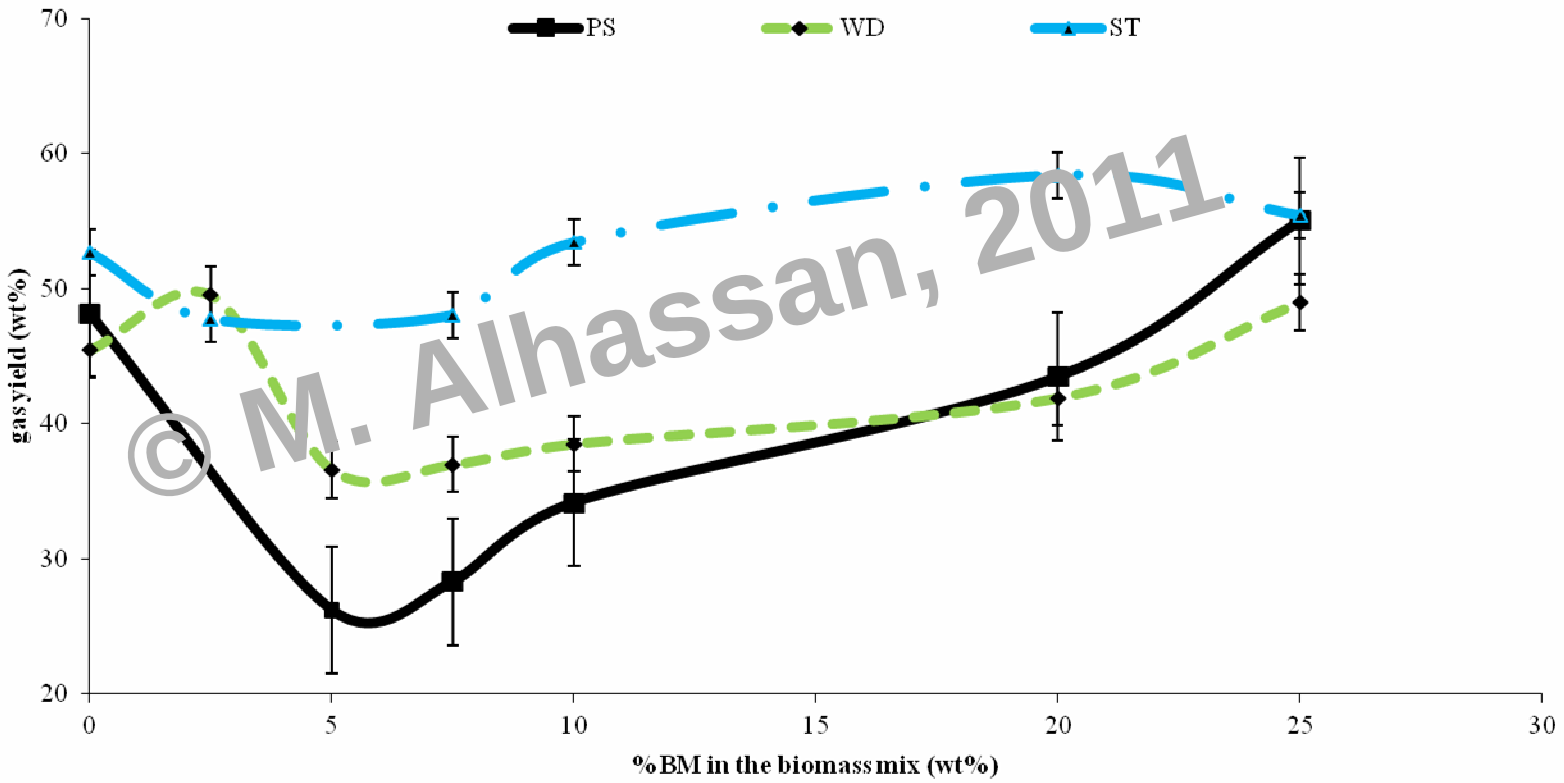
Char yield from WD, PS, and ST at various %wt addition of bone



Oil yield from WD and ST at various %wt addition of bone



Gas yield from WD, PS, and ST at various %wt addition of bone

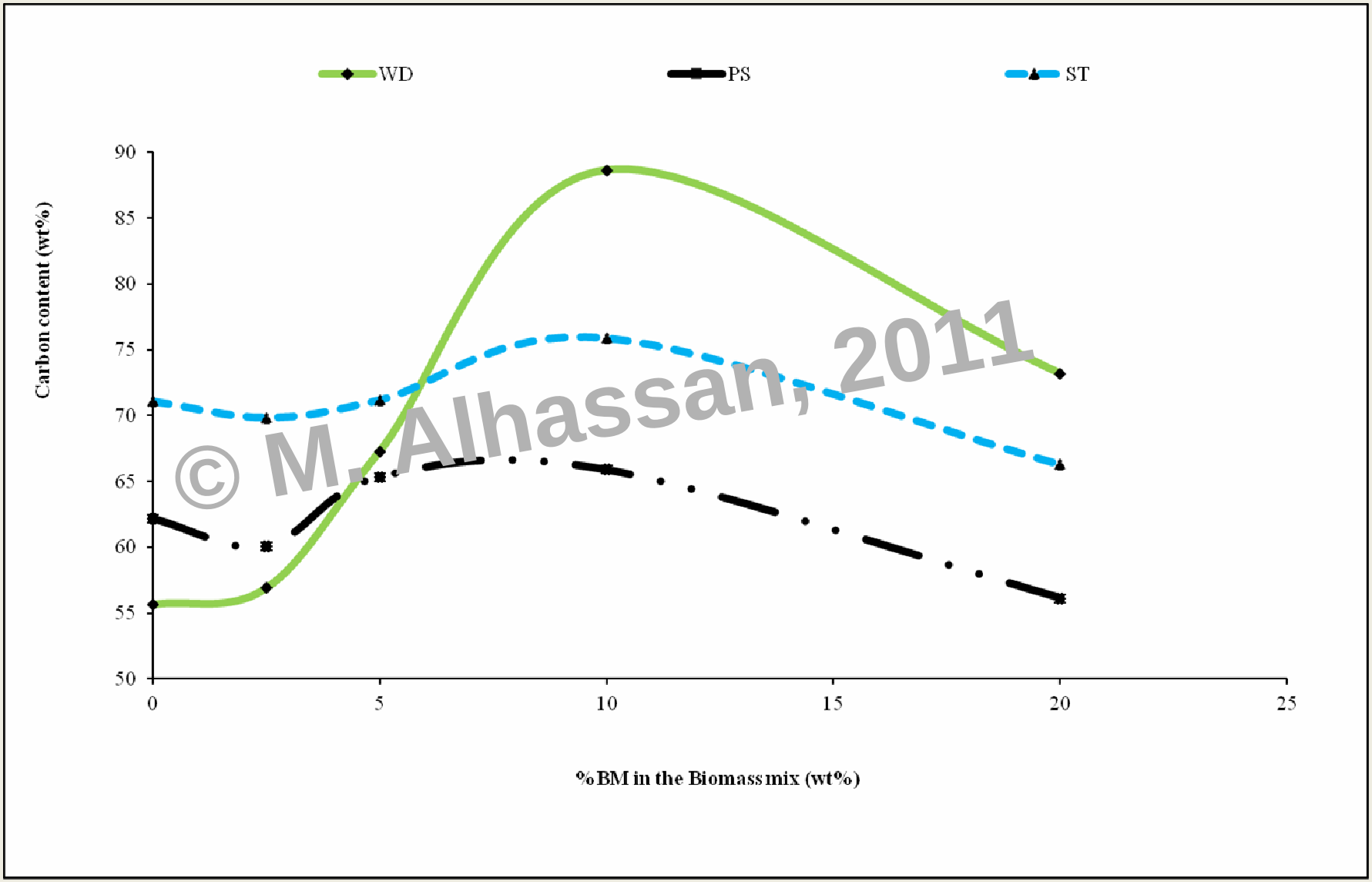


SUMMARY

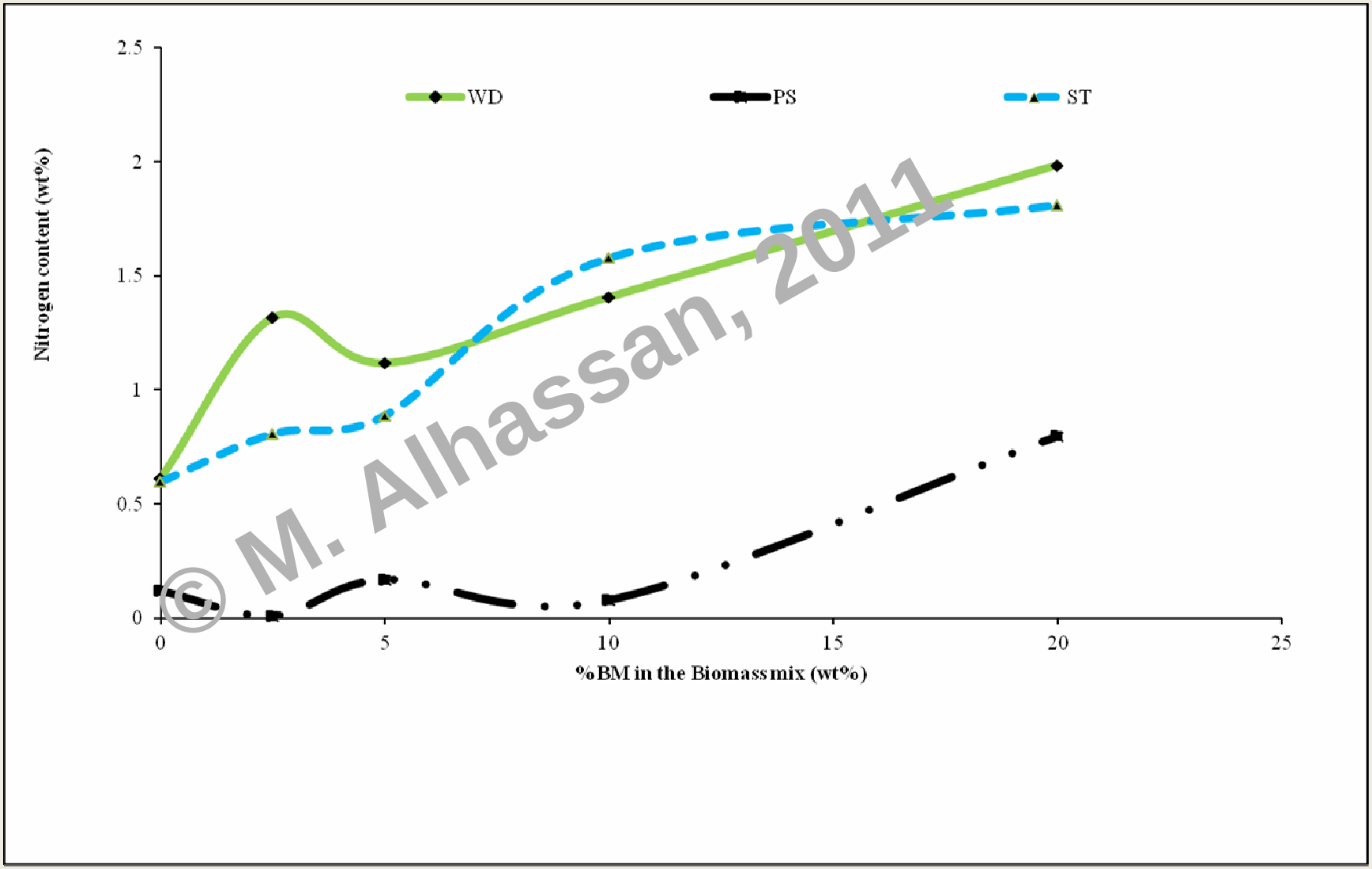
Effect of bone addition to the biomass

- Char high at 10wt%bone addition
- Oil high at 5wt%bone addition
- Gas high at 20wt%bone addition

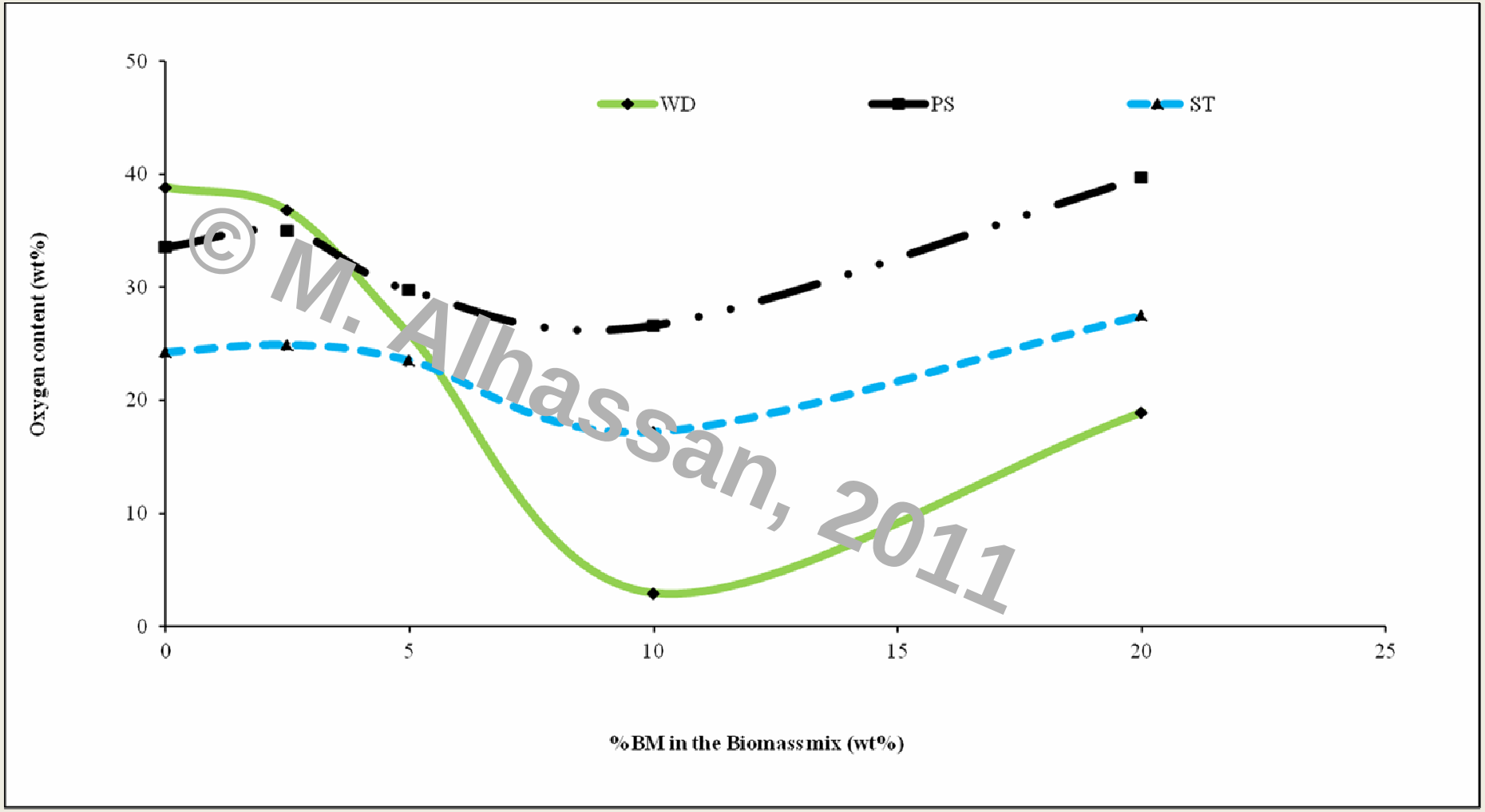
Carbon content of char from WD, PS, and ST at various %wt addition of bone



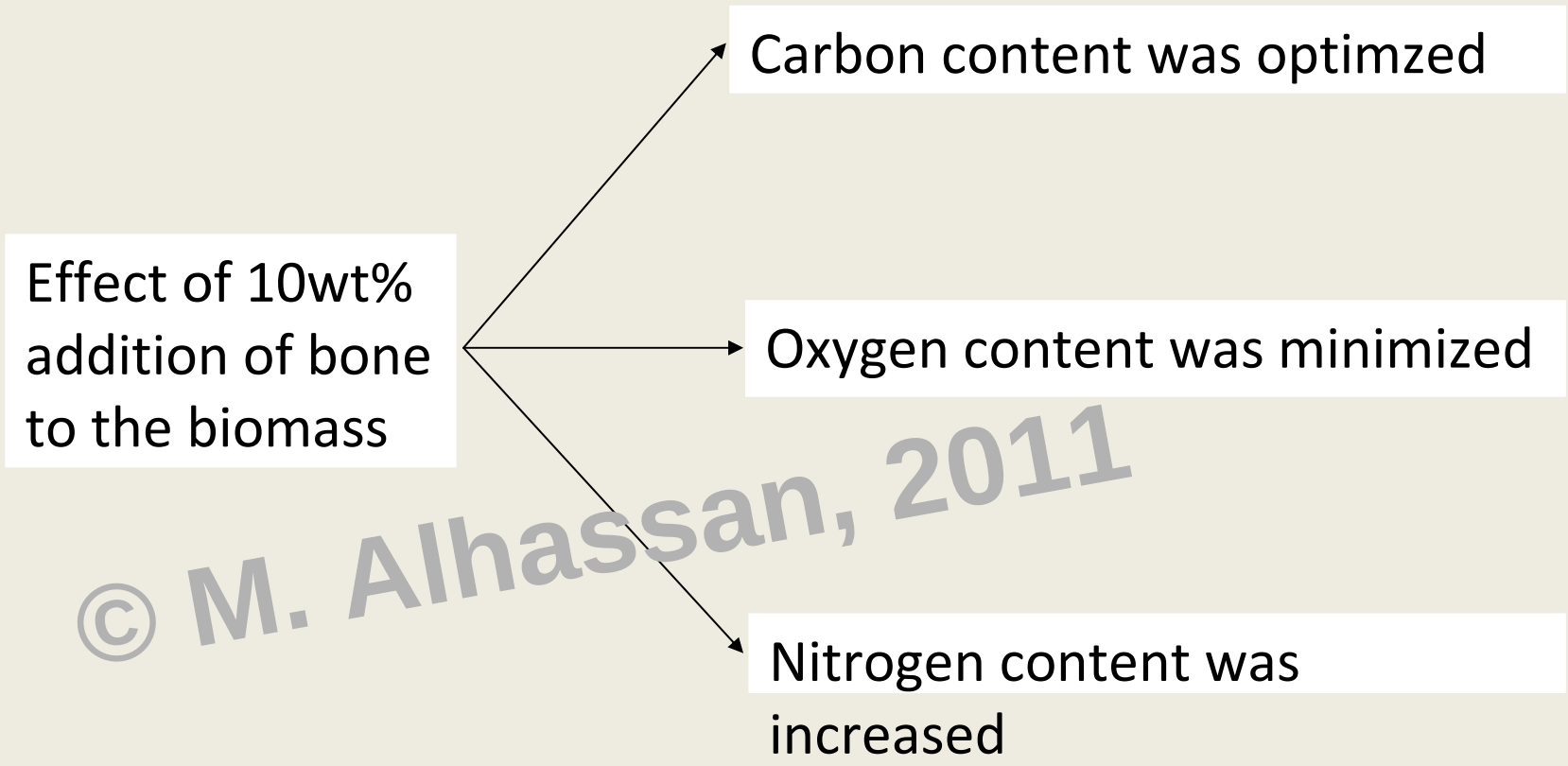
Nitrogen content of char from WD, PS, and ST at various %wt addition of bone



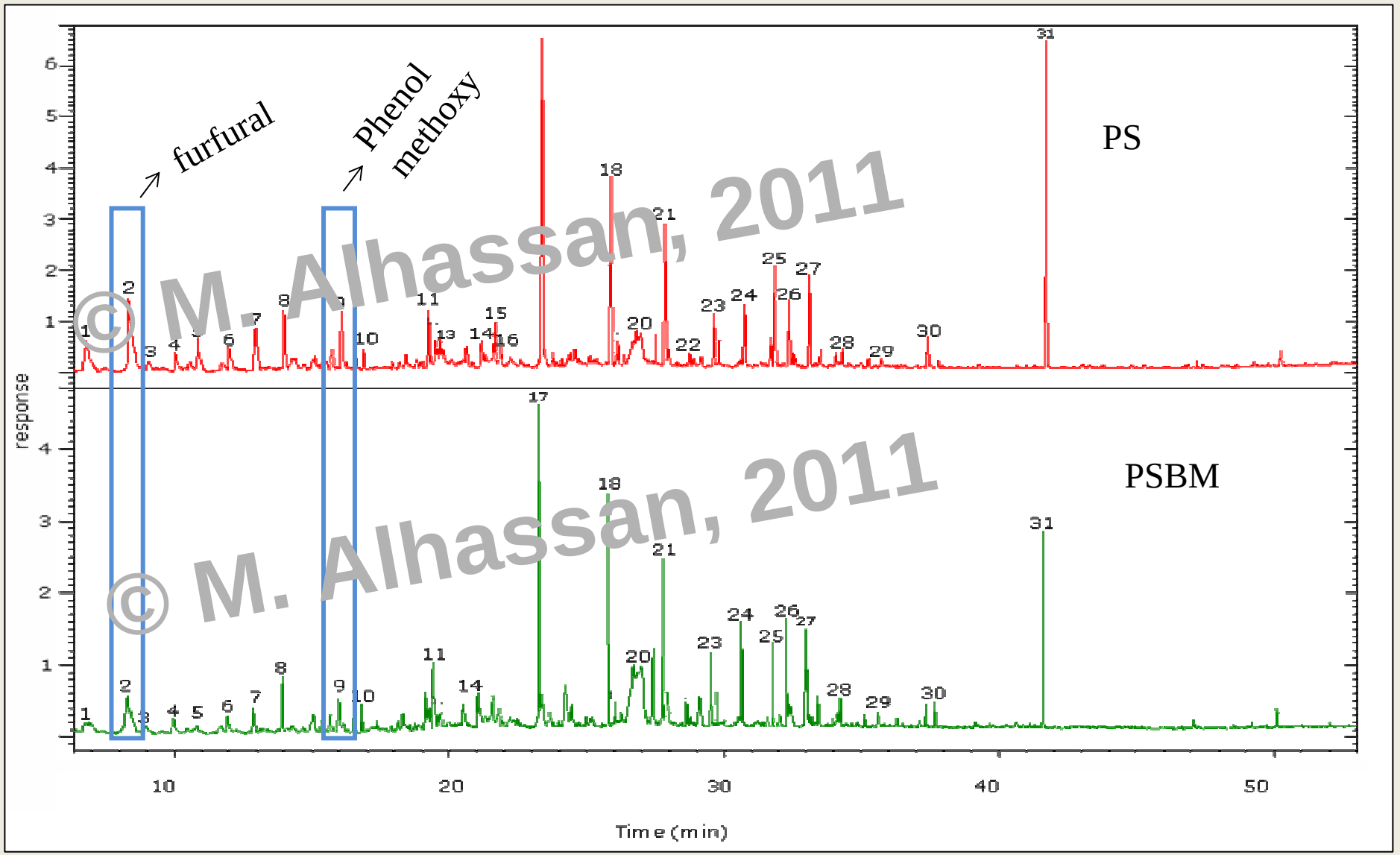
Oxygen content of char from WD, PS, and ST at various %wt addition of bone



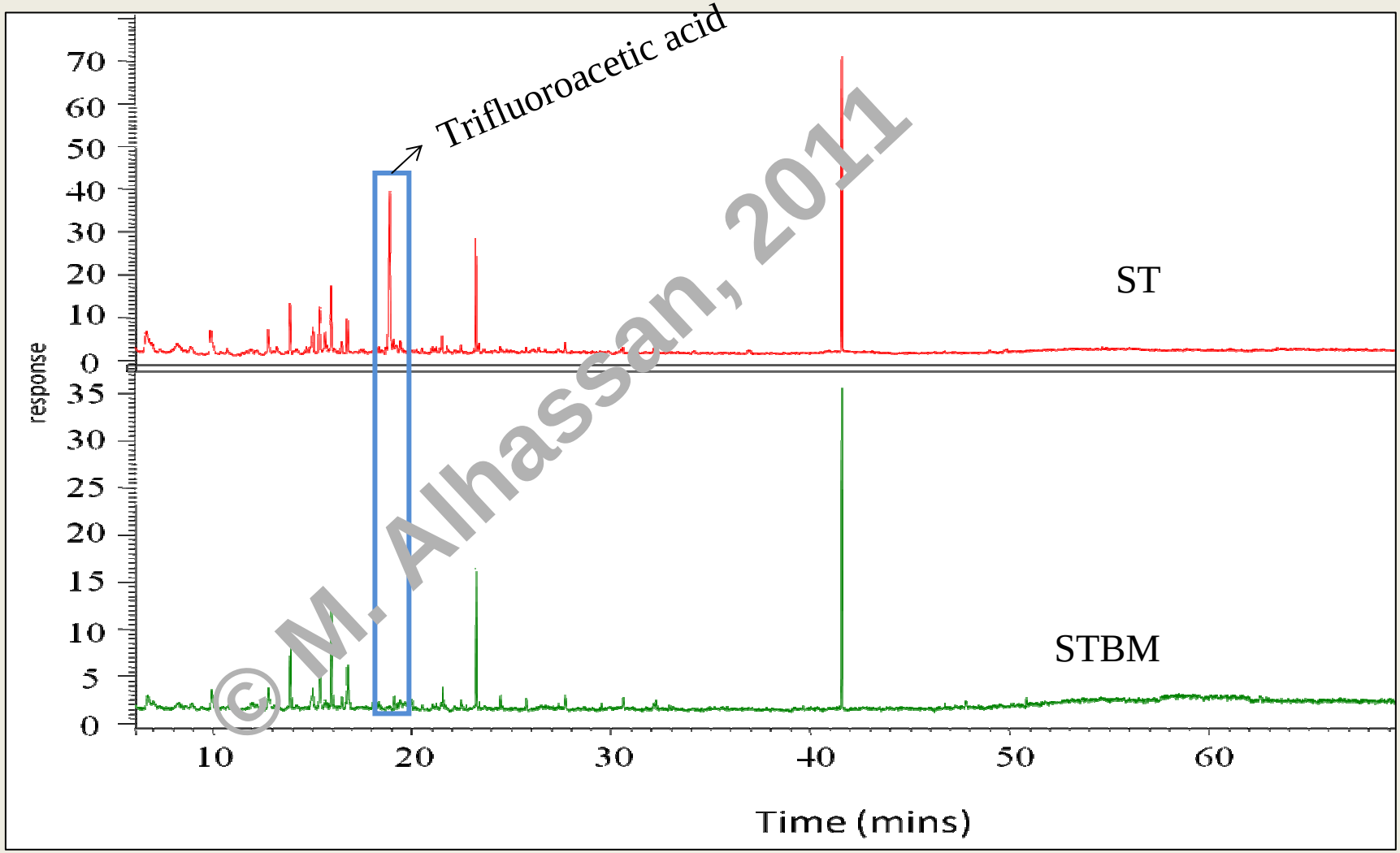
Summary on the elementary analysis of the char produced



GCMS analysis of oil from PS and PSBM



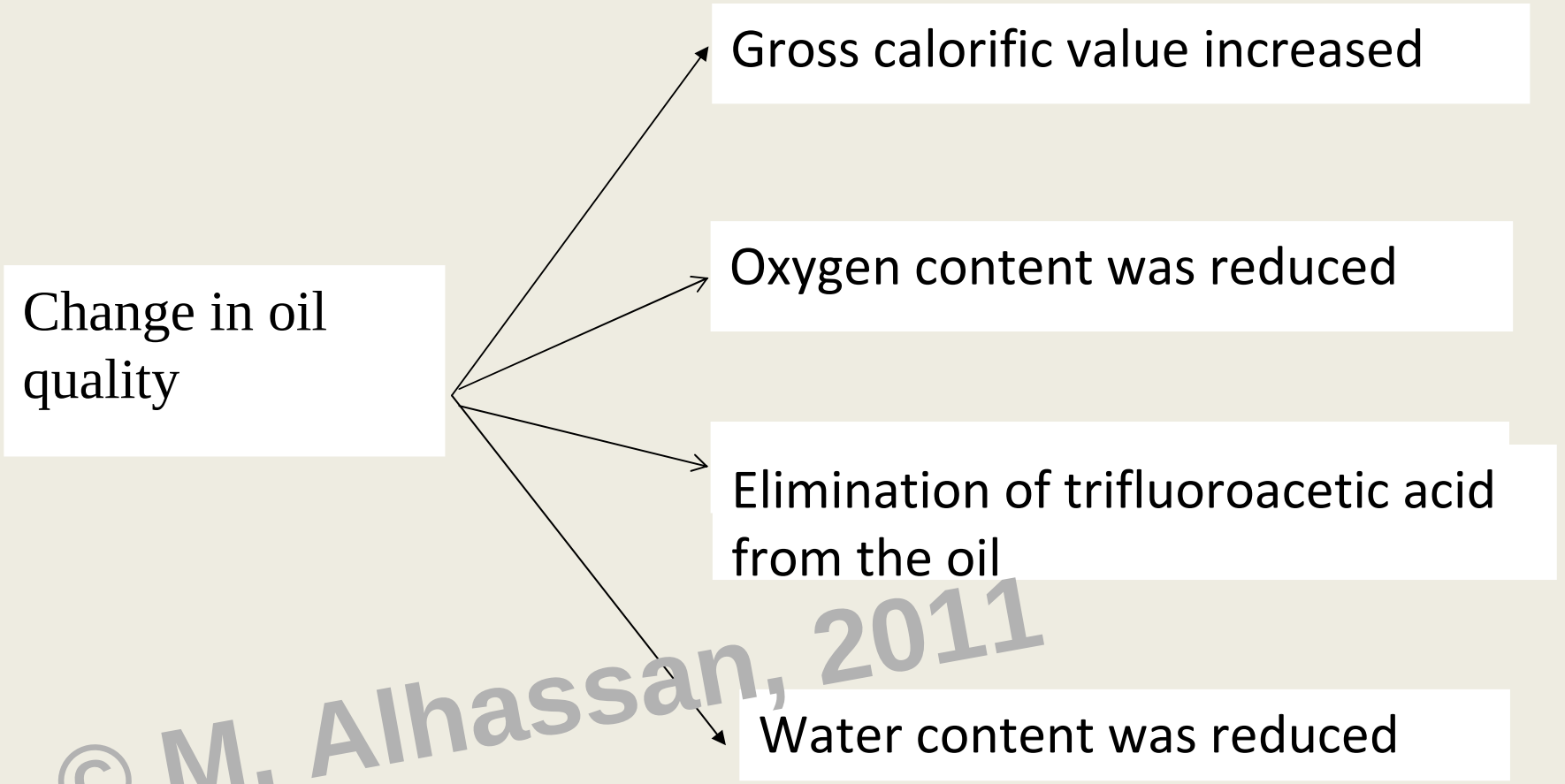
GCMS analysis of oil from ST and STBM



Proximate and ultimate analysis of oil produced from PS, PSBM10 and BM.

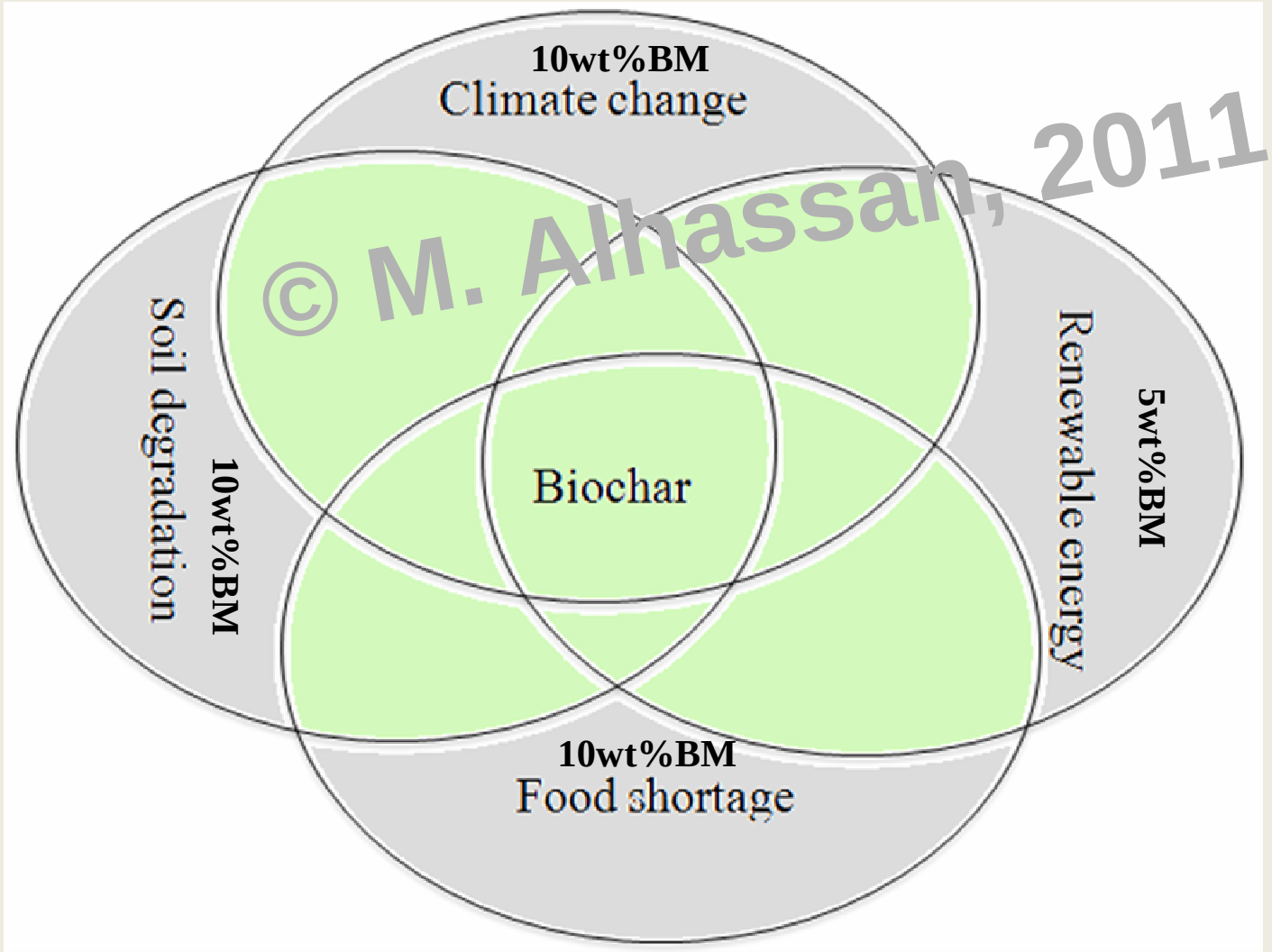
Properties of oil (wt%)	Ash	Moisture	volatile matter	fixed C	N	C	H	O	S	GCV Mj/kg
PS	0	38	48.8	13.1	0.2	55.6	4.7	39.6	<1	18.5
PSBM10	0	24.7	52.9	22.4	1.2	56.4	5.2	37.3	<1	19.9
BM	0.1	4.0	90.3	5.6	8.7	65.1	8.1	13.8	<1	31.2

Summary on oil quality



BIOCHAR: AN INTEGRATED SOLUTION

➢**Optimum wt% of bone in biomass mix for mitigation**



CONCLUTIONS AND RECOMENDATIONS

- Optimum char production can be achieved at 10wt% bone addition to the biomass during pyrolysis, while at 5wt%addition, optimum bio-oil production is favoured.
- At 20wt% and higher addition, higher amount of gas was generated.
- Carbon and nitrogen content of the chars were optimized while at the same time the oxygen content was minimized.
- Addition of bone to the biomass increase the energy content of the oil generated while reducing the oxygen and water content of the oil.
- bio-chars and oil produced can be suitable for Carbon sequestration, soil amendment or for renewable energy generation.

ACKNOWLEDGEMENT

The authors are grateful for the financial support by the Nigerian Petroleum Technology Development Fund for sponsoring the PhD programme.

Thank you for your kind attention!

mohammed.alhassan@nottingham.ac.uk
john.andresen@nottingham.ac.uk