On site conversion of olive tree prunings to biochar and environmental benefits

M. Ainatzoglou*, V.P. Aravani**, V.G. Papadakis**

**Damaskinoelies Ainatzoglou, Kiveri, 21200 Argos Greece*

***Department of Environmental Engineering, University of Patras, Seferi 2, 30100 Agrinio, Greece*

****Department of Civil Engineering, University of Patras, University Campus-Rio, Patras, Greece*

Introduction

Figure 1: Open –field burning of olive tree prunings.

Olive tree prunings are a major source of agricultural biomass wastes, in Greece and in other Mediterranean countries, and are mainly disposed of by burdening burning in the field. Pyrogenic Carbon Capture and Storage can be alternatively applied, using olive prunings as a feedstock. Flame cup pyrolysis kilns offer a relatively fast and easy, inexpensive and effective way for the carbonization of olive prunings and other biomass residues, with high carbon capture efficiency and rather low emissions.

Figure 2: Flame cup pyrolysis kiln.

High quality biochar can be produced. Kilns are portable and the procedure can be applied almost anywhere, where biomass exists, without expert's supervision. It appears to be a worthwhile biomass waste management alternative for further study, development, The aim of this study is to present the possibilities of flame cup pyrolysis kilns in order to manage olive tree prunings and produce valuable added materials, such as biochar.

Results & Discussion

The kiln of reference is based on the Kon-Tiki kiln of the Ithaka inst.

Figure 3: The kiln of reference.

In one application, 1150 kg of green, fresh olive prunings were used and 750 L of biochar (22% ash), weighing (laboratory dry) 140 kg, were produced.

Figure 4: Olive prunings.

Carbon capture was about 1/3 of the total C, of the initial biomass.

Figure 5: Biochar from olive tree prunings.

Biochar obtained from olive prunings is of very good quality, as showed by laboratory examination (class II-class III, EBC). The specific surface area is 250.48 $m^2 g^{-1}$ (BET) and the total 16 EPA-PAH were relatively low (<7mg kg^{-1}).

Table 1: Physicochemical characteristics of biochar obtained from olive tree prunings.

Parameter	Method	Unit	ar	db
Biochar characteristics				
Moisture	DIN 51718: 2002-06	% (w/w)	5.1	-
Ash content (550 °C)	DIN 51719: 1997-07	% (w/w)	20.7	21.8
Carbon	DIN 51732: 2014-07	% (w/w)	73.2	77.1
Hydrogen	DIN 51732: 2014-07	% (w/w)	2.1	2.2
Total nitrogen	DIN 51732: 2014-07	g/kg	9.9	10.5
Sulphur (S), total	DIN 51724-3: 2012-07	% (w/w)	0.11	0.12
Oxygen	DIN 51733: 2016-04	% (w/w)	4.7	5.0

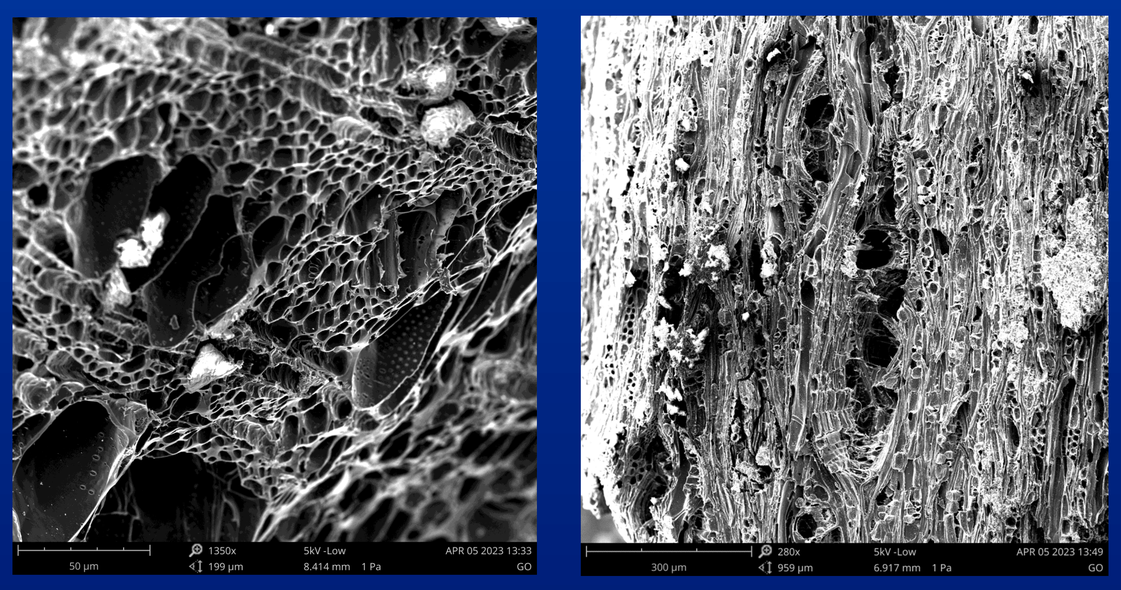

Figure 6: Electron micrograph image of biochar (obtained from olive prunings) structure, in cooperation with Prof. Wayne Teel, James Madison University. On the left at 1350x and on the right at 280x.

Conclusions

- Open flame pyrolysis can be applied directly in the fields and convert residual biomass (olive tree prunings) into biochar.
- The produced biochar is of good quality and can find several applications in soil or as a sorbent.
- CO_2 is captured in the form of C, and thus can contribute indirectly to the mitigation of climate change.