



## A Study on Wood Waste in Lahejan area in North of Iran

Jahangir Payamara  
Shahed University, Science Faculty Tehran-Iran

### Abstract

Lahejan is a city in north of Iran ( $36^{\circ}, 34', 38^{\circ}, 27' N$ ) with area  $58403 \text{ km}^2$ , farming area  $43690.5$  hectare, forest  $6198$  hectare and verdant fields  $40$  hectare. Wood waste generated from them in this city is more than  $100$  tons per day which can cause of environment problem in future. The alternative technique for utilization of wood waste is the carbonized product, which are charcoal and wood vinegar. The properties of charcoal are fixed carbon, ash, heat content, volatile matter, moisture content, and sulfur content. The major component of wood vinegar products are acetic acid, methanol, propanoic acid, phenolic and carbonyl compounds. The bio-test of wood vinegar to inhibit the growth of *xanthomonas comprestriis pv.* The acidity ranged from  $1.95$  to  $2.1$ . The major component in wood vinegar was observed to be acetic acid. The carbonization of wood waste can inhibit cancer diseases

**Key words:** Lahejan, Charcoal, Wood waste, Carbonization, Canker, Wood vinegar

### Introduction

Lahejan is a city with the population of  $73,000$  persons with area  $58403 \text{ km}^2$ , farming area  $43690.5$  hectare, forest  $6198$  hectare and verdant fields  $40$  hectare. The method for handling wood waste of Lahejan Metropolitan Administration was to separate wood waste into few groups based on the size of lump. Wood waste with less than  $10$  inches in diameter for coarse goods such as different types of dolls, decorative, with diameter less than  $4$  inches are conveyed to make compost and a large amount of wood waste with diameter large than  $4$  inches are transported to landfills. The quantity, properties, and characterization of carbonized products obtained from wood waste in Lahejan area based materials, are charcoal and vinegar were studied.

The bio-test of wood vinegar inhibiting bacteria growth was also studied. Charcoal can used as a firewood for cooking in household, wood vinegar can be used as a biocide for agriculture, lives lock etc [1]. Gas product can be recycled as a fuel for carbonization kiln during the carbonization process of wood waste and tar can be used as a wood preservatives. Wood waste samples were cut into wood chips by chipping machine.

## Instrumentation

The systematic diagram of carbonization kiln is shown in figure 1. The system contains of dryness and carbonization part, hot blast stove, discharge conveyer, burner, dryness, carbonization screw exhaust fan and furnace.

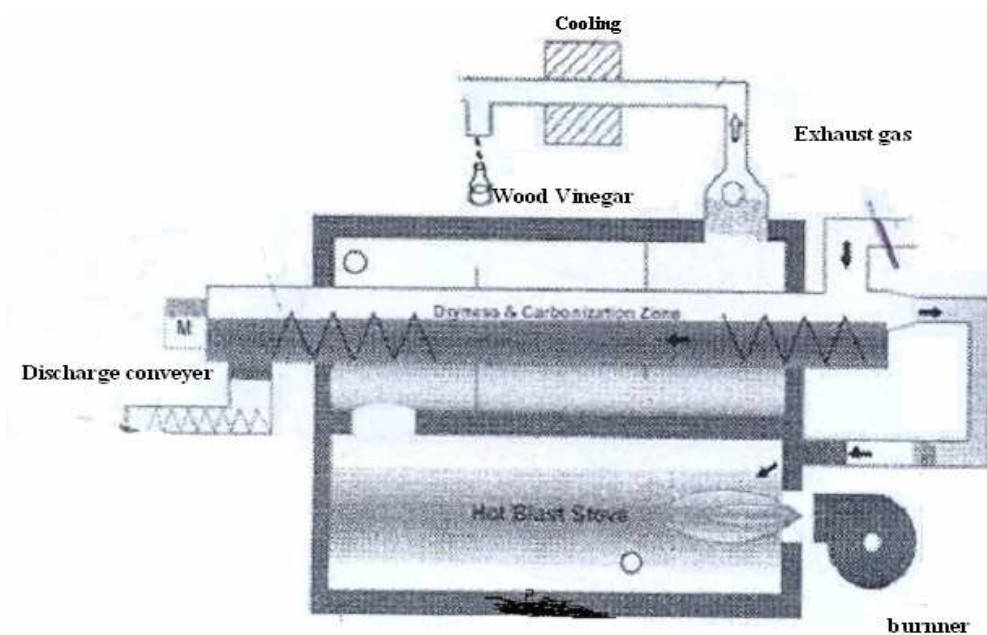


Fig.1. Schematic diagram of the carbonization process.

## Measurements

The charcoal and wood vinegar were collected at the end of reaction. The wood vinegar is kept for three months in dark room before testing. The testing of the wet and dry samples accomplished according to the [2-4]. The average amount of wood waste generated in Lahejan area can be measured about 40000 tons/year.

The products of from the carbonization process with the combustion temperature of 440°C for 100 minutes were as follows, gas 42.2%; wood vinegar 24.86%; tar 0.78% and charcoal 29.50%. The productions of charcoal at the average percentage ash, carbon, sulfur, heat content (kcal/kg), moisture content and volatile matter for wet sample obtained 14.9, 62.0, 0.21, 5772, 4.2 and 14.1 respectively and for dry sample obtained 16.2, 66.0, 0.20, 5900, zero and 15.7 respectively. The higher heat content can be obtained at temperature more than 500°C which it is accompany with decreasing in wood vinegar content. Wood vinegar obtained is viscous liquid, and with low pH. Wood vinegar contains acetic acid, methanol and propanoic acid [5], the average percentage 34.40, 5.20 and 2.00 respectively [6] which results agree with that of T Hata [6]. The

higher concentration of wood vinegar contains phenolic compound from lignin degradation which attributed to enhance the inhibition of bacteria growth.

Table 1. The production of carbonization of wood wast

Products	Average (%)
Charcoal	30.1
Wood vinegar	25.1
Tar	0.85
Gas	44.9

Table 2. Productions of charcoal from the carbonization of wood waste

Characterization	Wet weight (%)	Dry weight (%)
Moisture content	4.2	.0001
Volatile matter	14.1	15.8
Fixed carbon	62.0	66.0
Ash	14.9	16.2
Sulfur	0.21	0.20
Heat content (kcal/kg)	5,772	5,900

Table 3. The main chemical components of wood vinegar

---

Chemical components	Content (%)
Acetic acid	34.40
Propanoic acid	2.00
Methanol	5.20

---

### Conclusions

The carbonized products of the wood waste, which are charcoal for cooking and wood vinegar is dark brown, viscous liquid, and the acidity being. Wood vinegar shows the growth inhibition of the bacterial *xanthomonas campestris* pv. *Hasse Dye*.

### Acknowledgement

This work was supported by grant of research centre of Shahed University.

### References

- [1] T. Hirowata, **1994**. The Use of Wood Vinegar and Charcoal in Agriculture. ICCA, Japan.
- [2] ASTM D2015. **2000**. Standard Test Method for Gross Calorific Value of Coal and Coke by the Adiabatic Bomb Calorimeter. ASTM International, West Conshohocken, P.A.
- [3] ASTM D3172. **2007**. Standard Practice for Proximate Analysis of Coal and Coke. ASTM International, West Conshohocken, PA.
- [4] ASTM D3177. **2007**. Standard Test Methods for Total Sulfur in the Analysis Sample of Coal and Coke. ASTM International, West Conshohocken, PA.
- [5] C.S. Ku and S.P. Mum, **2006**. Characterization of Pyrolysis Tar Derived from

Lignocellulosic Biomass. *Jr. of Industrial and Engineering Chemistry*, **2006**, 12, 6, 853-861.

[6] T. Hata, T. Nakai, N. Kartal and Y. Imamura, *Jr. of Building and Environment*, **2005**, 42, 3, 1236-1241.