Preliminary

# Fractional Determination of Arsenic after Pyrolysis of Chromated Copper Arsenate (CCA) Treated Wood

## —For Recycling Wood Waste Containing Heavy Metals—

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Chromated copper arsenate (CCA) is known as one of the most widely used wood preservatives. Generally, wood for outdoor use is treated with wood preservatives to prevent insect attack and decay. CCA is used for many applications because of its high performance against weathering by rain and sunshine.

However, there have been serious environmental problems caused by CCA-treated wastes. Burning of CCA-treated wood waste is not a good method of disposal because of emission of highly toxic gases and residues in the ash. In particular, arsenic can gasify easily and the emission of arsenic must have a high environmental impact. It is estimated that a large amount of CCA-treated wood waste will be scrapped, not only in Japan, but all over the world, and there is no promising solution for the disposal of CCA-treated wood. Instead of combustion, pyrolysis is thought possible.

In this research, to investigate the behaviour of arsenic during pyrolysis, gasified arsenic compounds were collected in sequent traps (two quenching traps to liquidify aerosols and one TBAH trap to catch arsenic compounds) and chemically analyzed.

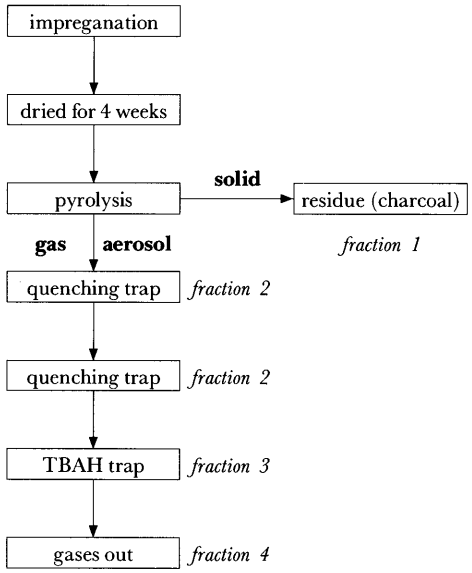


Fig. 1. Experimental procedure of pyrolysis of CCA treated wood.

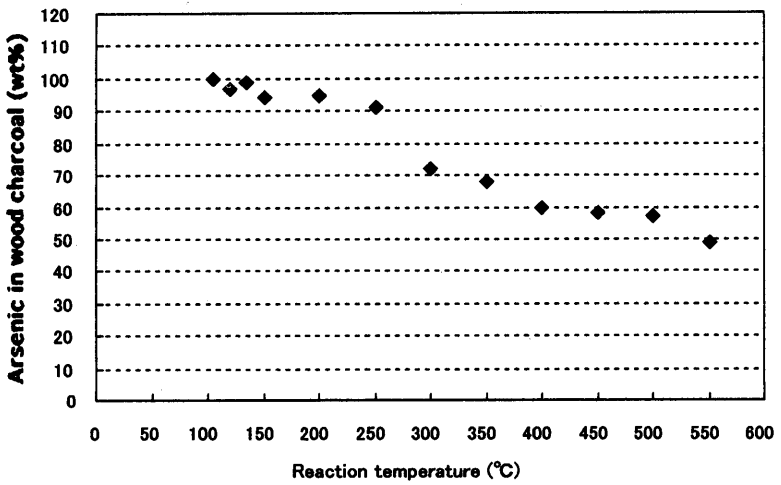


Fig. 2. Weight percent of arsenic in fraction 1.

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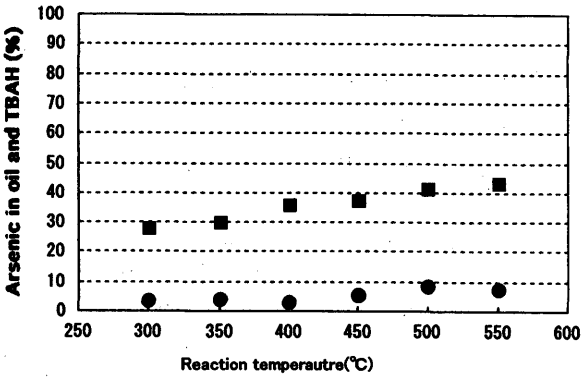


Fig. 3. Weight percent of arsenic in fractions 2 and 3. Legend ; ■ : arsenic in oil, ● : arsenic in TBAH.

Western hemlock lumber *(Tsuga heterophylla)* was treated with type 3 CCA salt (JIS K 1570) and dried at ambient temperature for four weeks. Then the pieces of CCA-treated wood were broken down into chips and milled to powder of less than 100-mesh, and the powder was mixed evenly to prevent the non-uniform distribution of CCA salts in the wood.

One gram of sample was pyrolyzed in an inert (N2) atmosphere using an electric furnace. The experimental conditions of reaction temperature and time were varied because these conditions were considered to be important factors. After the pyrolysis, the weight changes and arsenic content in the samples (wood powder, pyrolysis residues, liquid in the cooling trap and arsenic in the TBAH trap) were measured. Solid samples were dissolved completely in $HNO_3$ and the solution was analyzed using a fluorescent X-ray analyzer (XRF).

The process of this experiment is shown in Fig. 1 and the arsenic collected in each fraction is shown in Figs. 2 and 3. From the results of fraction 1 (Fig. 2), the arsenic in CCA treated wood appeared to be released at around 150–200°C. From the results of fractions 2 and 3, more arsenic was collected in the quenching and TBAH solution when the arsenic release increased. However, from the results of fraction 4, little arsenic was released into the atmosphere in this experiment.

In conclusion, arsenic emission during the pyrolysis of CCA-treated wood was detected at a wide range of reaction temperatures, and it was recognized that arsenic gasified easily at very low temperatures. The high mobility of arsenic in this research was thought to result from arsenic trioxide whose subliming point was identified as around 135°C. Arsenic trioxide is the reducted state of arsenic pentoxide, which exists in CCA-treated wood in a non-reacted state. Most of arsenic pentoxide in CCA are reacted and fixed in wood components, but unreacted arsenic pentoxide is reduced to arsenic trioxide and easily gasifies during pyrolysis. In order to restrict the emission of arsenic at low temperatures, CCA-treated wood should be pretreated.