Development of Neutron Activation Techniques for the Measurement of Boron and Carbon Based Preservatives

Cornelia Chilian
Greg Kennedy
Ecole Polytechnique of Montreal
Montreal Canada

ABSTRACT

Non-destructive neutron activation analysis (NAA), with its inherent accuracy and sensitivity for many chemical elements, is widely applied for wood preservative retention and penetration quality assurance tests, especially for preservatives containing iodine, copper, tin, arsenic or chlorine. However, NAA cannot measure directly some light chemical elements such as boron, carbon, nitrogen or hydrogen.

Carbon based preservatives can be analyzed by adding to the preservative a tracer containing an element easily detectable by NAA. Several possible tracers were investigated based on the following criteria: minimum amount necessary for obtaining an accurate assessment of the amount of carbon based preservative; non-presence in the natural wood matrix; fast analysis; low toxicity; availability. After evaluating compounds containing iodine, chlorine, sodium and bromine, it was found that an organic bromine compound was the most suitable. Untreated wood samples were found to contain typically 0.1 ppm bromine. Bromine is activated by neutrons to produce Br-80 which has a half-life of 18 minutes and is easily detectable; the detection limit for tracer bromine was found to be 0.05 ppm. An accurate assessment of the amount of carbon based preservative could be achieved with 1% of the bromine compound added as a tracer.

For boron based preservatives, boron can not be activated by neutrons and detected directly, but the amount of boron can be determined by its neutron absorption because the isotope B-10 has a high neutron absorption cross section. We measured the neutron flux depression inside 7 mL sawdust samples spiked with different amounts boric acid solution, using 30 mm long and 1 mm diameter copper wire monitors. Copper is easily activated by neutrons to produce Cu-64 with a half-life of 12 hours. Measured by gamma spectrometry, the Cu-64 activity was correlated with the boric acid concentration, which varied from 400 ppm to 10,000 ppm. The Cu-64 activity decreased as the boron concentration increased, due to the neutron flux depression. The detection limit for boron in 7 mL sawdust samples is 500 ppm.
Investigation into Copper Indicators for Treated Wood

Mike H. Freeman  
Independent Wood Scientist  
Memphis, TN

James A. Brient  
Consulting Chemist  
Missouri City, TX

Craig R. McIntyre  
McIntyre Associates  
Walls, MS

ABSTRACT
Currently most of the non-industrial treated wood in the USA is preserved with a copper based product and over 30 percent of the industrial treated wood is treated with copper based preservatives as well. Three commonly employed copper indicators have been in wide spread use for determining either pressure treatment preservative penetration or simply the presence of copper in treated wood. All three of these systems are currently standardized by the American Wood Protection Association but the systems vary in their sensitivity. This work was undertaken to investigate the current third party trends in the USA to use Rubeanic Acid for Copper penetration detection over that of Chrome Azurol S and at the same time investigate other possible copper indicators for treated wood.

Keywords: Copper, Indicators, Penetration, Rubeanic Acid, Chrome Azurol S

Statistical Process Control Approach to Treated Wood Quality and Assessment of Current Quality Data Standards

Matthew Scholl Ph.D.  
Eddie Price Ph.D.  
Georgia-Pacific

ABSTRACT
Over the past six months a task group of wood treaters, third party inspection agencies, consultants, code engineers, code officials, and chemical suppliers met to review the American Wood Protection Association's (AWPA) quality control procedures. The T7 Task Force on Residential Pressure Treatment Process Level of Specification Compliance was formed as a voluntary proactive committee concentrating on evaluating potential enhancements to AWPA QC requirements particularly related to M2-07 and M3-05. The group focused on a range of areas which included: (1) reduced sampling and inspection, (2) continuous sampling, (3) 10% assay reduction, (4) plant re-sampling for penetration, (5) plant re-sampling for retention, (6) significant figures, (7) penetration requirements, (8) third party inspection and enforcement, (9) analytical calibration, (10) generic tags, (11) estimation of co-biocide retentions, (12) mixed charges, and (13) plywood sampling. The concentration of this paper is to introduce ideas proposed by the T7 Task Force more specifically statistical process control (SPC) concepts. Throughout the group’s activities there were major discussions around plant statistical QC requirements and third party QC enhancements. The plant QC centered on two primary SPC concepts of analyzing and tracking retention. Both SPC concepts use control charts that use individual data points and running averages to monitor treated wood quality retentions. They however differ in the sample size of subsets used to calculate the running average and the
approach used to determine the lower control limit (LCL). The first concept, (Concept #1) uses a 10-sample running average with a LCL adjusted for wood variability. The second concept, (Concept #2) utilizes a 5-sample running average with a LCL that is not adjusted for wood variability. A sub-task force group evaluating third party enforcement and inspection criteria is also considering similar SPC concepts. The two SPC concepts and proposed editorial changes to AWPA standards have been put forth for industry consideration.