LONG-TERM SHELF-LIFE OF INDOLE-3-BUTYRIC ACID SOLUTIONS

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The use of concentrated indole-3-butyric acid (IBA) solutions is widespread in the nursery industry, however no data is presently available on the shelf-life of these solutions. The purpose of this study was to provide practical information about the effect of storage conditions on the long-term shelf-life of concentrated IBA solutions. The concentration, solvent, and storage environment were chosen to represent conditions that a plant propagator would encounter.

IBA was purchased from two suppliers, United States Biochemical [USB] (Cleveland, Ohio) and Sigma Chemical Co. (St. Louis, Missouri). A bulk quantity of IBA was prepared for each concentration (5,000, 1,000, 0 ppm) and chemical supplier; 50% (v/v) isopropyl alcohol was used as the solvent since it is readily available to the public. The color of freshly prepared solutions depended on the chemical supplier. A 5,000 ppm solution of IBA prepared using the USB product was a light-yellow color. The intensity of this color is proportional to the concentration. The solution (5,000 ppm) prepared from the Sigma product was clear.

The bulk supply for each solution was dispensed (60 ml/bottle) into either clear or amber glass bottles. Two bottles were prepared for each treatment (temperature, bottle color, concentration, and chemical supplier). During the storage period, bottles were located in one of three locations (laboratory shelf, refrigerator, freezer). One series of bottles was stored on an open shelf in a laboratory (72 to 77°F). The laboratory was lighted by conventional fluorescent fixtures. The remaining bottles were stored in the dark in either a refrigerator (43°F) or freezer (32°F). Solutions were analyzed by high pressure liquid chromatography (HPLC) and the mung bean rooting bioassay at the beginning and end of the storage period. HPLC was used as the method for chemical analysis. The rooting bioassay was used to monitor the biological activity of IBA and to detect the presence of inhibitory or promotive compounds that might be produced during storage.

Results indicated that concentrated (5,000 ppm) IBA solutions (USB) can be stored at room temperature in a clear glass bottle for at least 4 months without a significant loss in biological activity of the

solutions (Table 1) or breakdown of the compound (Table 2). Results for the 1,000 ppm solutions were similar (data not shown).

Table 1. Effect of 4 months storage on the biological activity of a 5,000 ppm IBA solution.

Storage Conditions		Mean number of roots per cutting*
Bottle color	Temp. (°F)	
clear	72–77	84
amber	72–77	83
clear	43	90
clear	32	83
—*control, fresh*—		79

*Means of 30 mung bean cuttings, all of which rooted. Means are not significantly different. LSD (p = 0.05) = 11.3

Table 2. Percent of 5,000 ppm IBA remaining after storage.

Storage Conditions		Length of storage (mo)	
Bottle color	Temp. (°F)	4	6
clear	72–77	102%*	102%*
amber	72–77	106	106
clear	43	102	109
clear	32	110	110

*Accuracy of the HPLC method (dilution and analysis) is ±6%

The inability to detect any significant loss in biological activity or breakdown of the product was rather surprising because solutions stored at room temperature had changed from the initial light-yellow, to a bronze color. Exposure to low light does not appear to influence color production as solutions stored in a clear or amber bottle were identical in color. Presumably the color could be a result of a highly colored breakdown product(s) of IBA. The product(s) would be produced in very small quantities since no significant amount of breakdown could be detected (Table 2). The color could also be produced by a contaminant that has no influence on the biological activity of a concentrated IBA solution (Table 1).

The development of the colored product(s) was influenced by temperature. A significant change in color occurred in solutions stored at room temperature, while only a slight change in color occurred in refrigerated solutions. Solutions stored in a freezer maintained their original color. No difference in biological activity or amount of breakdown was detected between the Sigma and USB products stored at room temperature (data not shown) even though the color of the original solutions was different. Color of the Sigma and USB solutions was essentially identical by the end of the storage period.

Analysis of solutions after an additional 2 months of storage at room temperature (6 months total storage) indicated no significant loss in biological activity of the solutions (data not shown) or breakdown of the compound (Table 2). A significant breakdown of IBA was measured after IBA had been stored at room temperature for 19 months.

It is important to note that this study focused on the storage of concentrated IBA solutions in glass bottles. Therefore, these results may not apply to storage in plastic containers or to the potassium salt of IBA (K-IBA). Because the solvent for the potassium salt would usually be water, bacterial growth might be a problem in stored aqueous solutions. Whether the shelf-life of the salt would be similar if it were dissolved in alcohol is not known.

Based on personal observation, extended storage of concentrated alcohol solutions of IBA does result in a discoloration of the inside surface of white or clear plastic bottles. Whether IBA is being absorbed into the plastic is not known.

VOICE: Ralph, where is the Parafilm available that you use in your budding and grafting?

RALPH MOORE: This can be obtained from any medical supply house.

VOICE: In using an IBA solution, where evaporation of the alcohol can occur, does this not change the concentration of the IBA solution?

JAMES ROBBINS: We did not deal with this situation in our studies, but I suspect the IBA concentration would increase as more and more alcohol evaporates during the use of the material.

VOICE: What are the proper storage conditions for the IBA crystals?

JAMES ROBBINS: The chemical supply houses recommend on the bottles the proper storage conditions. I believe they recommend storage in a refrigerator for IBA—and for IAA, storage in a freezer.