Stop the Rot in Flower Shipments

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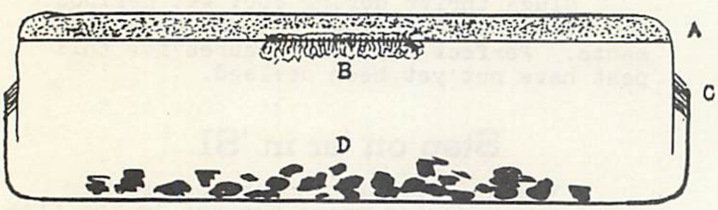
Rot in flower shipments can be prevented by the use of brominated activated charcoal suspended over the flowers. Flowers packed in tight enclosures for ease and cheapness of handling develop a high humidity which favors rot. It is usually impossible to lower the temperature of flowers sufficiently to overcome rot in shipment. This combination of high humidity and favorable temperature provides ideal conditions for the growth of fungi and the subsequent damage to flowers.

Similar problems occur in handling fruits and vegetables. Rotting of berries and some of the fleshy vegetables is common.

Such molding is not readily controlled on flowers, probably because blooms may be easily damaged or discolored by the use of conventional fungicides. Remedial measures suggested at present consist of sanitation, and temperature and humidity control. Obviously, there are many uncertainties in such a program.



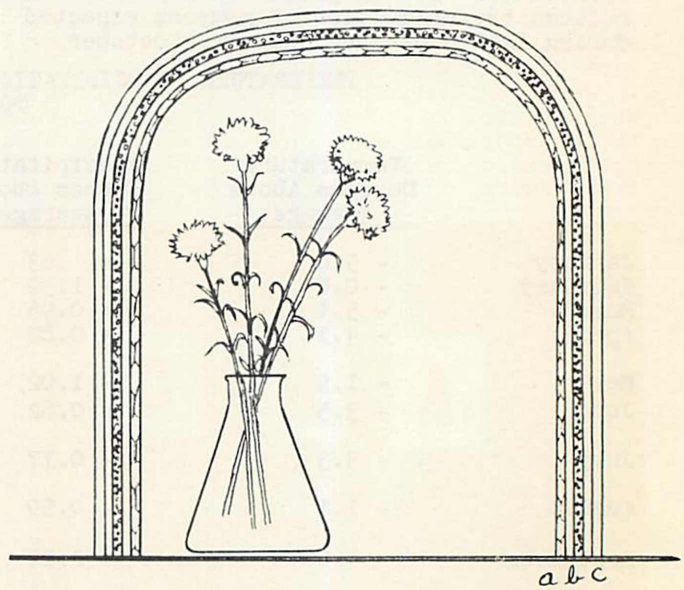
Petri plate enclosure showing agar (a), Plasteline seal (b), fungus colony (c) and charcoal (d).

A new approach to the problem was suggested by some studies made in connection with the control of ethylene production by plant material. You will recall that the product known as brominated activated charcoal (referred to as BAC) seemed especially effective in neutralizing the effects of ethylene gas produced by the plant material. At the same time, it appeared in some instances that the secondary molding often accompanying ethylene injury was greatly reduced when the charcoal was used. This was especially apparent in trials with orchid flowers. BAC stopped the injury due to self-produced ethylene and also prevented mold invasion of the flower.

To further investigate these aspects of mold control, pure cultures of fungi were confined with BAC. The mere presence of the charcoal caused considerable inhibition of the fungus colony. Further, spores of Botrytis, when "dusted" on agar in culture plates, were killed by the action of the brominated charcoal. These experiments indicated clearly that BAC actually had the fungicidal properties.

Carnation flowers, sprayed with Botrytis spores, were used in the first trials with plant materials. Flowers were enclosed under bell jars and BAC, pasted between layers of Kraft paper with Carters Rubber Cement, was suspended on chicken wire over the flowers. We observed that flowers so treated remained free of mold after several days' confinement at room temperature. Flowers enclosed without charcoal or with plain activated charcoal lacking the bromine decomposed rapidly in a comparable period due to the action of mold. Apparently bromine from the charcoal was released slowly. This gas acted directly as a fungicide in a fumigation action. A solution of bromine water introduced into a bell jar enclosure with carnation flowers gave control of the rotting but was harmful to the flowers.

Pompon chrysanthemums were next inoculated with a suspension of Ascochyta ray blight fungus. This organism causes much damage to flowers during shipment from the South. Again, the charcoal was applied by suspension above the inoculated plant material and again the material gave complete control of rotting,



Enclosure of flowers showing wire neeting (a) for support of BAC pasted between Kraft paper (b) inside bell jar (c).

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while untreated flowers broke down rapidly in confinement.

Another trial was made with gladiolus flowers inoculated with Botrytis. BAC seemed effective in controlling the growth of the fungus in this instance, too.

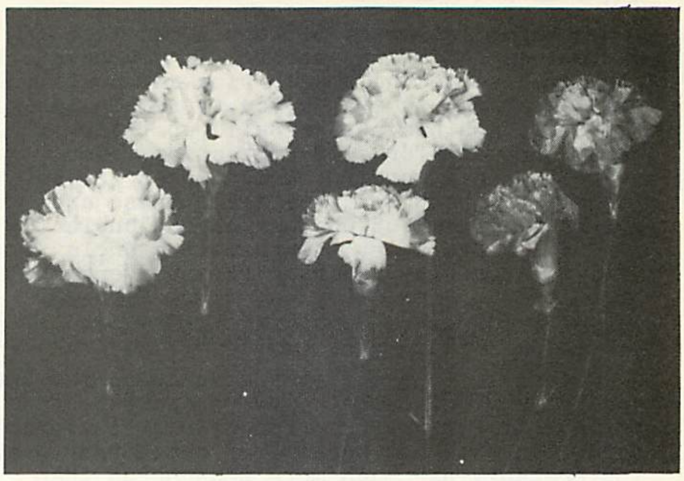
In an effort to simulate practical shipping conditions BAC was applied to small boxes containing carnation flowers that had been previously inoculated with the fungus suspension. The flowers were first wrapped in waxed paper, next in the paper containing the BAC. They were then placed in a waxed florists' cut flower box and put at 50°F for two weeks. At the end of this period, the treated flowers showed absolutely no sign of mold invasion, while comparable flowers packed without the BAC were completely worthless because of mold damage.

A preliminary trial with the material was made on raspberries and strawberries by Dr. R. M. Smock, of the Cornell Pomology Department. Dr. Smock observed that BAC merely suspended above quart veneer containers of these fruits, which had been placed in larger metal cans, definitely reduced molding. A trial in our laboratory indicated that molding of tomatoes was reduced by use of the BAC.

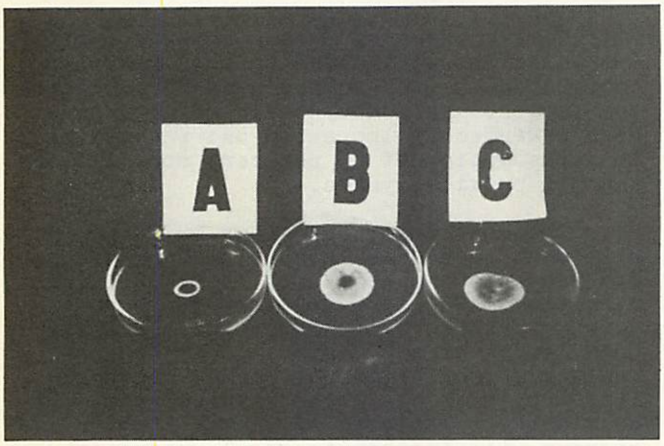
Thus, the brominated charcoal used with plant materials in confinement appeared to control, or even kill, mold on a wide variety of products. Essentially, the treatment seemed to affect a sterilization of the plant materials.

The inevitable difficulties naturally enough have appeared. Complications observed were as follows. The charcoal had to be held in rather close proximity to the material to be protected in order to be effective. When the charcoal was merely spread on the bottom of an enclosure rather than suspended over the flowers, it was far less effective in the control of molding. Secondly, the treated charcoal was actually toxic to flowers if it came in direct contact. If the flowers were wet, BAC also seemed toxic, not because of direct contact, but rather, we think, because the bromine, liberated from the charcoal, apparently dissolved in the water on the surface of the flowers and formed the strong and toxic hydrobromic acid. Finally, in atmospheres of high relative humidity (above about 90 per cent), the charcoal absorbed large amounts of water, became noticeably wet and lost effectiveness. However, this action was sufficiently slow so that the BAC seemed to accomplish most of the protective fumigation.

Thus, despite the difficulties involved, the brominated activated charcoal seems to



Appearance of carnation flowers sprayed with a Botrytis suspension following enclosure under bell jars with (left to right) BAC, bromine water, no amendment.



Appearance of Alternaria colonies following confinement with BAC (A) and ordinary activated charcoal (B). (C) plate served as control.

Appearance of pompon chrysanthemum flowers sprayed with an Ascochyta suspension following enclosure under a bell jar with BAC (L). Control (R).

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Appearance of gladioli flowers sprayed with a Botrytis suspension following enclosure under a bell jar with BAC (L). Control (R).

have promise as a protectant for plant material, not only in its role as a neutralizing agent for ethylene, but also because of its fungicidal property. Should this method of fungus control prove practical, it may be that different absorbing media other than charcoal or different chemicals other than bromine will prove more adaptable for use. However, the use of brominated activated charcoal is of considerable interest and has application to commercial conditions.

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