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Brominated Charcoal to Prevent Fading of Vanda Orchid Flowers [1]

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ORCHID BLOSSOMS OF *Vanda Miss Agnes Joaquim* constitute a major portion of the export trade of Hawaiian-grown ornamentals to the mainland United States. Until recently, federal quarantine regulations required that these blossoms be fumigated with methyl bromide prior to shipment. Although this treatment was effective in destroying the oriental fruitfly (*Dacus dorsalis*), it shortened the marketable life of the flowers by approximately 25%. They faded prematurely during the warm months of the year and were made unduly susceptible to rot organisms during the cool season.

In numerous attempts to restore the marketable life of the fumigated blooms, it was discovered that sealing brominated charcoal with the flowers tended to reduce the rate of fading. Although the fumigation requirement was shortly rescinded, the investigations on the use of brominated charcoal were continued because premature fading is a major problem in *Vanda* shipment, even in unfumigated flowers.

The presence of a fading flower among normal ones, especially in an air-tight container, will result in the fading of all flowers in a day or so under ordinary conditions. The cause is believed to be ethylene liberated by the fading flower.

When Lindner (2) subjected normal *Vanda* flowers to 1 part of ethylene in a million parts of air, they faded within 24 hours. Illuminating gas, automobile exhaust fumes, and tobacco smoke, all of which probably contain ethylene, also caused *Vanda* flowers to fade. When ripe fruit sections of papaya, banana, orange, apple, and mango were sealed into containers with *Vanda* flowers, the latter faded prematurely. Conversely, when fading *Vanda* flowers were sealed with green bananas and mangoes, the rate of ripening was accelerated. Young tomato plants sealed in a desiccator with fading blooms produced epinasty symptoms, a typical ethylene response. African marigold plants responded similarly. Carnations produced "sleepy" response (premature closing of flowers) in the presence of fading *Vanda* flowers.

In addition to normal senescence, ethylene and possibly other oxidizing gases, disturbance or removal of the pollinia also causes fading in *Vanda* flowers. Utmost care must be used in packaging (especially in air-tight containers) flowers for the export trade. Should an old or damaged flower be packaged with normal ones, the latter fade within a short time. Although the inclusion of brominated charcoal in such packages will not stop the fading process in the already-fading flowers, it tends to prevent or delay the fading of normal flowers.

Production of some toxic material, probably ethylene, by flowers of snapdragons and calceolarias caused flower drop; additions of brominated charcoal to flower containers completely prevented all flower drop (1).

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Investigations were first carried out with activated vegetable charcoal which w brominated in the laboratory by subjecting the carbon to bromine gas. Non-brom nated vegetable charcoal was found to be ineffective in preventing the fading *Vanda* blooms. Subsequent tests were carried out with commercial brominat (23% by weight) activated cocoanut charcoal because its granular nature (1 to mm. in diameter) makes it easier to use than the powdered vegetable charco Non-brominated cocoanut charcoal is ineffective.

Following the method of one shipper, the blooms (1 dozen) used in these studie were placed in a paper tray which was in turn placed in a cellophane package an sealed. Observations were made through the transparent cellophane. The tests we conducted in 2, 3, 4, or 5 replications per treatment, each replicate consisting of flowers in a tray.

To study the efficacy of brominated charcoal in preventing or retarding the fadin of *Vanda* blooms, one obviously fading flower, the pollinia of which were remove was included among 11 normal flowers in a sealed package. In other studies, onl normal blooms were used.

In a test in which one fading bloom was sealed with normal blooms in the presen of brominated activated vegetable charcoal, the life of the flower at room tempera ture (75°–84° F.) was prolonged by more than 5 times. The average number o days required for the 12 blooms to fade completely was 20.4 for the blooms seale with the brominated carbon and 3.8 for the flowers sealed without carbon. Th carbon was placed on a watch glass above the flowers. When only normal flower were used, the life of the flowers sealed with the brominated activated vegetabl charcoal was more than twice that of the flowers sealed without the carbon.

The effectiveness of brominated activated cocoanut charcoal in prolonging the li of *Vanda* flowers in the presence of a fading bloom at room temperature is illustrat in TABLE 1.

TABLE 1

Effect of Brominated Activated Cocoanut Charcoal on Fading of *Vanda* Flowers at Room Temperature (75°–84° F.)*

Weight (gm.) of brominated charcoal †	*Average number of days required for complete fading of 12 flowers*
0	2.0
1/2	2.0
1	2.0
2	2.3
3	2.7
4	4.3
5	5.0
6	5.0
7	5.0
8	6.0
12	6.0
13	6.0
14	7.0
15	7.0
Difference between treatment means necessary for significance at P = .05	.7
Difference between treatment means necessary for significance at P = .01	1.0

* One fading flower was sealed with 11 normal ones in each replicate — 3 replications per treatment.

Because it is desirable not to have the charcoal come in direct contact with the delicate flowers, in subsequent tests the brominated cocoanut charcoal was placed under a layer of stiff gauze (crinoline), the mesh of which does not allow the charcoal particles to sift through. The flowers were placed on this material on the bottom of the tray. The data obtained at different storage temperatures indicate the possible advantage of using the brominated charcoal even with normal blooms (TABLES 2 and 3).

TABLE 2

Effect of Brominated Activated Cocoanut Charcoal on Fading of *Vanda* Flowers Stored Initially at 87° F. for 19½ Hours, and then Transferred to Room Temperature (75°–84° F.)*

Weight (gm.) of brominated charcoal †	*Average number of days required for complete fading of 12 flowers*
0	5.8
5	5.5
6	5.5
7	6.8
8	9.8
9	9.5
Difference between treatment means necessary for significance at P = .05	2.0
Difference between treatment means necessary for significance at P = .01	2.8

* Only normal flowers were employed in each replicate — 4 replications per treatment.
† Brominated charcoal was placed beneath a layer of crinoline at the bottom of the tray.

TABLE 3

Effect of Brominated Activated Cocoanut Charcoal on Fading of *Vanda* Flowers Stored Initially at 55° F. for 5 Days, and then Transferred to Room Temperature (75°–84° F.)*

Weight (gm.) of brominated charcoal †	*Average number of days required for complete fading of 12 flowers*
0	7.0
4	9.8
5	10.5
6	10.0
7	10.0
8	11.2
9	11.2
Difference between treatment means necessary for significance at P = .05	2.6
Difference between treatment means necessary for significance at P = .01	3.6

* Only normal flowers were employed in each replicate — 4 replications per treatment.
† Brominated charcoal was placed beneath a layer of crinoline at the bottom of the tray.

Brominated charcoal takes up moisture and becomes less effective as an adsorbent, especially when excessive amounts of moisture are sealed with the flowers (TABLE 4).

TABLE 4

Effect of Degree of Wetness of Flowers on the Efficiency of Brominated Activated Cocoanut Charcoal in Preventing the Fading of *Vanda* Flowers at Room Temperature (75°–84° F.)*

Weight (gm.) of brominated charcoal †	*Degree of wetness of flowers* ‡	*Average number of days required for complete fading of 12 flowers*
0	Slight	2.0
0	Excessive	2.0
4	Slight	3.0
4	Excessive	2.0
5	Slight	3.0
5	Excessive	2.0
6	Slight	3.5
6	Excessive	2.0
7	Slight	5.5
7	Excessive	3.0
8	Slight	5.0
8	Excessive	3.0
Difference between treatment means necessary for significance at P = .05		1.1
Difference between treatment means necessary for significance at P = .01		1.6

* One fading flower was sealed with 11 normal ones in each replicate — 2 replications per treatment.

† Brominated charcoal was placed at the bottom of the tray in direct contact with the flowers.

‡ Slight wetness — only sufficient moisture to maintain turgidity. Excessive wetness — more moisture than necessary to maintain turgidity.

The data show that brominated charcoal may be employed to prevent or delay the fading of packaged *Vanda* flowers in transit, especially when fading or injured blooms are accidentally packaged with normal blooms. It is important that moisture sufficient to maintain turgidity of the blooms be provided, because the brominated charcoal (especially high dosages) tends to cause the flowers to wilt. Excessive moisture, however, will cause a reduction in adsorptive surface area of the carbon particles. Furthermore, excessive amounts of brominated charcoal, particularly at high temperatures, may liberate enough free bromine to burn and fade the flowers. Thus, from the practical standpoint, it is of utmost importance to determine the correct amount of brominated charcoal and moisture to use per given number of flowers in order to maintain the efficacy of the charcoal and at the same time maintain the turgidity of the blooms. Practical methods of using this material must also be determined.

REFERENCES

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