



ROBERT KOCH Industries, Inc.

Dyes • Pigments • Fragrances • Specialty Products

Dyeing Fresh Cut Flowers and Foliage with Absorption (Systemic) Floral Dyes

Product Reference Sheet #101



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SYSTEMICALLY DYEING FRESH CUT FLOWERS

Quick Reference Sheet

- 1** Dye only high quality flowers that have been freshly cut or stored dry in a cooler. Flowers stored in water do not dye well because their water uptake is minimal.

- 2** Clean dye containers thoroughly before use. Plastic or glass containers are recommended.



- 3** Add 1-2 ounces of dye per gallon of warm water (104°F, 40°C). This is equivalent to 7.5-15 grams per liter. Stir well to make sure the dye is fully dissolved.



- 4** Add 1 teaspoon of TW-20 wetting agent per gallon (1 milliliter per liter) and mix.

- 5** Recut 1 inch (2.5 cm) from bottom of stems immediately before placing the flowers in the dye solution.

- 6** Remove flowers when color is evenly distributed throughout the petals, being careful not to over-dye. Rinse stems with water. Dyeing times for most cut flowers range from 30 minutes to 1 hour.

- 7** Transfer to water containing a fresh flower food to allow the remaining dye within the stems to reach the flower.



Systemically Dyeing Fresh Cut Flowers



White roses tinted with Sky Blue 2388 (variety - Vendela).

Use of Dyes



Green carnations for St. Patrick's Day have been a long-standing tradition. This carnation was tinted with Kelly Green 2302.

Choice of Dyes

Note: These instructions are for dyeing fresh cut flowers and foliage. For instructions about using Absorption Floral Dyes in glycerin preserving applications, consult our reference sheet #121, and publications 420 and 421. Information on dyeing flowers and foliage that will be air-dried is found in reference sheet #102.



Bright, vivid colors are currently in vogue.



Yellow sunflowers tinted with Hot Pink 2880 create a striking contrast.

Koch Color™ Absorption Floral Dyes are widely used to systemically dye fresh cut flowers and foliage. The process starts by thoroughly dissolving dye in hot water. Flower stems are recut and placed in this solution. As the flowers drink the water, the dye travels up the stem, coloring the flowers and foliage. In the floral trade, systemic dyeing is also referred to as tinting.

Absorption dyes can be used to:

- Produce colors not available naturally
 - Blue Roses
 - Red Sunflowers
 - Green Carnations, etc.
- Create special holiday and seasonal colors
 - St. Patrick's Day
 - Fourth of July
 - Halloween
 - Christmas, etc.
- Tint flowers for weddings, parties, school colors, etc.
- Enhance flowers that cannot be sold because of over-production and/or changing market trends.



The choice of dyes used to tint fresh flowers is very important. Most dyes manufactured for industrial or textile use are incapable of systemic absorption. Koch Color™ Absorption Floral Dyes are extremely pure, high strength, water-soluble dyes, carefully selected for this unique application.

Dyes can be used to change the color of surplus flowers or those with low market demand. Yellow roses (variety - Gold Strike) are dyed orange using Pink 2214.

Systemically Dyeing Fresh Cut Flowers



Tinted Ammi Majus (false Queen Anne's Lace) creates a wonderful filler foliage.



Spider mum tinted with Sky Blue 2388.



These mums are tinted with Yellow 2375, Hot Fuchsia 2888 and Sky Blue 2388.

Packaging

Dyes are available in the following sizes:

4-oz jar

1-lb jar

5-lb jar

25-lb drum

100-lb drum

Custom sizes are available.

Coverage

One pound of dye will tint approximately 10,000-15,000 carnations. Other flowers may vary.



*Is it a boy or a girl?
Pink and blue carnations.*



Tinting Bells of Ireland (Moluccella laevis) creates wonderful color for fall arrangements.

Systemic Dyeing: Detailed Instructions

What Flowers and Foliage Can Be Dyed?



Above: Tinted flowering kale (*Brassica oleracea*).

Below: Agapanthus tinted with Hot Pink 2880.



Condition of Flowers

This question is best answered by experimentation. The process is simple and requires little time. When experimenting with new flowers, remember that varietal differences, stage of harvest and the condition of the flowers are important factors.

Varietal Selection



Some varietal differences can have a major impact on the tinting process. For example, the variety of Chrysanthemum at left was systemically dyed with Blue Lace 2321. The striations in the petals is a clear indication that the flower is better suited to the immersion dyeing process.

The following table lists flowers known to tint well:

Alstroemeria	Flowering Kale
Agapanthus	Genistra
Aster	Gerbera
Carnations	Godetia
Baby's breath (<i>gypsophila</i>)	Hydrangea (Hortensia)
Bells of Ireland	Leptospernum
Bouvardia	Myrtle
Chrysanthemums	Queen Anne's Lace (<i>Ammi Majus</i>)
Cymbidium orchid	Roses
Dahlia	Solidaster
Eryngium	Solidago
Eucalyptus	Sunflower
Feverfew	Waxflower

For best results, only high quality flowers should be dyed. Flowers should be full-centered. Stems should be healthy and strong. Foliage should be lush with good leaf development. This shows that the stems were harvested from healthy, well-grown plants. Flowers grown under a "wet system," i.e. one that uses water liberally, tint better than flowers grown under regimes that use water sparingly. [Ref 1] Significant stress during growth produces harder, more lignified stems, which dye poorly.

Systemic Dyeing: Detailed Instructions

Condition of Flowers



Flowers that have dehydrated for a short period of time will absorb the dye solution more quickly.

Flowers must be capable of sufficient water uptake for optimum dyeing. In simple terms, they must be thirsty. Cut flowers that have been stored in water are generally not used for dyeing. Since their water uptake is minimal, their dye uptake is minimal. Many flowers tint better if they are allowed to “dry out” or wilt for a short period of time after harvest. Some companies have “dehydration rooms” that have warm air and low humidity to promote dehydration. A few hours usually suffice. However, care must be taken not to cause excess stress resulting in damage to the flowers.

While most tinting is done at the grower level, it is still possible to do so at the wholesale and retail levels. Flowers shipped from the grower to the wholesaler lose moisture during transit. They generally arrive in a dehydrated condition and tint well. Retailers can ask their wholesaler for flowers that have been dry-stored in the cooler rather than stored in buckets of water.

Preparing the Dye Solution

Dye Containers



Clean all dye containers thoroughly before preparing the dye solution. Dirty containers contain bacteria and other stem plugging contaminants. If bleach (sodium hypochlorite) is used as a disinfectant, it is important to thoroughly rinse containers to avoid possible bleaching of the dye. Plastic buckets are inexpensive and come in many sizes. Taller buckets can be used to provide support for long-stemmed flowers. Glass jars and vases work well for testing.

How Much Dye Do I Use?

For general use, dissolve 1-2 ounces of dye per gallon of water (7.5 – 15 grams per liter). Lighter concentrations result in pastel shades, higher concentrations produce intense, vivid colors. The color of dyed flowers also depends on how long the flowers remain in the dye solution and the rate of uptake.

Preparing the Dye Solution

How Much Dye Do I Use?

Recommended Dye Concentrations for Systemic Dyeing

Light Shade	1/4 - 1 ounce per gallon	2-7.5 grams per liter
Medium Shade	1 - 2 ounces per gallon	7.5-15 grams per liter
Strong Shade	2 - 4 ounces per gallon	15 - 30 grams per liter

Conversion Factors 1 ounce = 28.4 grams 1 gallon = 3.8 liters

Using high dye concentrations results in shorter dyeing times. Low dye concentrations allow for more control over the rate of dyeing, making it easier to produce pastel shades without over dyeing. Take care when using high dye concentrations to ensure that the dye is fully dissolved. If not, stem plugging can occur. Over-dyeing can lead to a shortening of vase life. Each pound of dye tints 5,000-15,000 stems depending on the flower variety.

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When handling dyes, follow rules of good industrial practice. Wear rubber gloves, safety glasses, protective clothing (such as an apron), and a NIOSH-approved dust mask. Dyes are not generally considered hazardous but may cause irritation with some people. Consult the Material Safety Data Sheet (MSDS) prior to use. Dyes may stain skin, clothing, and work surfaces. Handle carefully to avoid dust dispersal and spills.



Simple, inexpensive gram scales are readily available from most lab supply companies.



These intensely colored mums were tinted with Brilliant Purple 2203. Purple remains a widely used color in today's market.

Preparing the Dye Solution

Dissolving Dyes



Adding a Wetting Agent

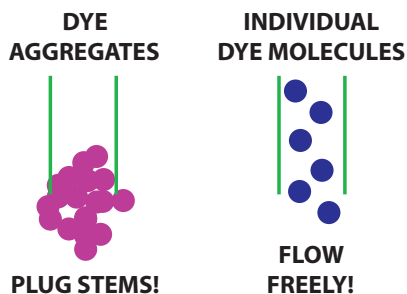


Dyed flowering kale in a fall arrangement.

Water Quality



Inexpensive digital pH meters are available from most laboratory supply companies.



Stir completely and use hot water to ensure that dyes are fully dissolved

When adding dye to water, add the dye slowly while stirring. Avoid adding all the dye at once. Dyes function best when they are completely dissolved. Some dyes tend to float on the surface and are harder to dissolve. It is much like adding flour to water. If not thoroughly dissolved, dyes can form large clusters of loosely bonded molecules called aggregates. Because of their large size, these aggregates have a hard time traveling up the flower stem.

Mixing with very hot water is the best way to dissolve dyes. Water at or above 160°F (71°C) is recommended. Be careful to let the temperature cool down to at least 110°F (43°C) before placing flowers in the solution.

Adding a wetting agent to the dye solution often improves uptake. Wetting agents (surfactants) work by lowering the surface tension of the dye solution, making systemic uptake easier. Use only anionic or nonionic wetting agents. Some flowers can be dyed successfully without a wetting agent. However most flowers tint better when a wetting agent is added. We recommend testing the use of a wetting agent to see if it helps improve your dyeing process.

We have evaluated many different surfactants and have found that Polysorbate 20 works very well with a wide variety of flowers. Our trade name for this product is TW-20. The recommended use rate is one teaspoon per gallon (approximately one milliliter per liter). TW-20 is a liquid making it easy to use. Add the wetting agent last, after the dye has been dissolved. Stir slowly to avoid excess foaming.

We offer TW-20 in quart, gallon and five-gallon containers. One quart of TW-20 is sufficient for every 12 pounds of dye.

Water quality is important. Hard water can adversely affect some dye solutions. Hard water is water that contains high levels of minerals like calcium and magnesium. High iron levels can also cause problems. Dye molecules form chemical complexes with these impurities, lowering their mobility in the vascular system. Avoid using hard water when dyeing fresh cut flowers.

While post-harvest research shows that most cut flowers rehydrate better if the water is slightly acidic, (pH between 3.0 – 4.5. [Ref 2]), it is unclear whether adjusting pH has a beneficial effect on dye uptake. Most absorption dyes contain sulfonic acid groups which lower the pH of the dye solution. Some flower dyeing operations will add citric acid to further lower the pH. A pH meter should be used to check the acidity level. There are many makes and models available in all price ranges. Be careful not to lower the pH too much to avoid causing damage to flowers or dyes. Most absorption dyes have good stability down to a pH of about 3.0. Below this level, however, color and solubility changes can occur.

Preparing the Dye Solution

Preventing Bacterial Contamination of Dye Solutions



Tinting hydrangeas increases color range.

Adding a bacteriostat (biocide) slows the formation of bacteria and allows dye solutions to be used for a longer period of time. Potassium sorbate is a very potent inhibitor of bacteria, yeast and mold. It is widely used in the food and beverage industry to preserve the freshness of many food products.

Potassium sorbate is safe to use, making it an excellent bacteriostat for floral dye solutions. It provides a broad range of microbial protection. It should be added to the dye solution when it is first made, after the dye has been dissolved. It comes in the form of a white powder or granule and is used at the rate of 0.13 ounces per gallon (1 gram per liter).

Potassium sorbate is offered in the following sizes:

4 ounces 1-lb jar 5-lb jar 25-lb pail

The effectiveness of potassium sorbate at inhibiting microbial formation is pH dependent. It works only in acidic solutions. Potassium sorbate has an upper effective pH limit of approximately 6.5. Above pH 6.5, it is not effective.

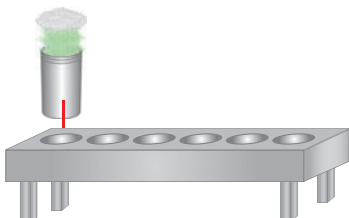
The addition of most absorption dyes lowers the pH of the solution and a pH adjustment is usually not necessary. However, if the water is alkaline, it may be necessary to add some citric acid to lower the pH. Use a pH meter to check to see if an adjustment is needed. Most laboratory supply companies offer inexpensive digital meters that are easy to use.

If a pH meter is not available, use the following table as a guide.

Potassium Sorbate and Citric Acid Use Rates For Preventing Bacterial Formation in Dye Solutions		
	English Units of Measure	Metric Units of Measure
Potassium Sorbate	0.13 ounces per gallon (\approx 1 tsp/gal)	1 gram per liter
Citric Acid	1/4-1/2 teaspoon per gallon	0.5-1.0 gram per liter

The Dyeing Process

Temperature of the Dye Solution is Important



A heated hot water bath keeps the tint solution warm and accelerates the dyeing process.

Conditions of the Dyeing Area



Temperature and relative humidity are important factors affecting the dye uptake in cut flowers. A combination temperature and humidity meter can be used to monitor conditions in the dyeing area.

Dye uptake at different solution temperatures varies. Many flowers can be dyed at room temperature. Some flowers are even occasionally dyed in the cooler. The main advantage of heating the dye solution is to accelerate the dyeing process. The rate of dyeing increases as water temperature increases. Warm dye solutions contain less dissolved gasses (air bubbles) and have lower viscosity resulting in faster uptake. Do not exceed 110°F, (43°C) to avoid injuring the flowers.

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Dye solutions can be kept warm by placing the dye buckets in a heat table. The buckets sit in a tank filled with warm water. The water is heated by either an immersion heater placed in the tank or a hot water heater connected to the tank. When the water in the heat table falls below a certain temperature, a thermostat activates a switch. This switch turns on a pump that circulates hot water, or turns on the heating element to bring the water back to the specified temperature. This keeps the dye solution at a constant warm temperature throughout the dyeing process.

The temperature and humidity of the dyeing location affect the dyeing process. Warm air, low relative humidity and gentle airflow promote transpiration and increase the rate of uptake. (Transpiration is the evaporation of water from plant surfaces, mainly leaves.) Ambient conditions in many grading areas are too cool and humid for efficient dyeing. A separate dyeing area that is heated and dehumidified can shorten dyeing times. Bright lighting has also been shown to increase the rate of dye uptake [Ref 3]

Not all flowers dye well in warm dry environments. Holley and Baker [Ref 1] state that flowers dyed at 36°F (2°C) in the cooler have more diffused colors in carnations. The dyes are less sharply aggregated into zones of the petals. Our tests with baby's breath (gypsophila) show that dyeing in cool, humid areas gives better results. Sunflowers prefer lower humidity and warmer air. Experiment with different ambient conditions to determine what is best for your flowers.

The Dyeing Process

Recut Flower Stems and Place in Dye



Recutting stems just before dyeing removes trapped air that can reduce absorption of the dye solution.

How Long Do I Leave Flowers in the Dye?



Stainless steel food strainers can be used to filter the dye solution between uses.

Recut flower stems immediately before placing them in the dye solution. Once a flower is harvested, air slowly enters the stem and travels a short distance before it becomes trapped. These air blockages (embolisms) can prevent water (and dye) from traveling up the stems.

To ensure removal of any air blockages, recut at least one inch (2.5 cm) of foliage from the bottom of the stems. Stem cutters should be clean and sharp. Dull or undersized cutters can actually pinch the stems making absorption difficult.

Do not overcrowd containers. Air should be able to circulate freely between the stems. If buckets are too crowded, transpiration is reduced and uptake is impaired.

Leave stems in dye solution until color is lightly distributed throughout the flower, being careful not to overdye. Dyeing times for most flowers range between 30 minutes and one hour; however considerable variation may be expected. Flowers fully turgid (full of water) will dye much slower than flowers that are somewhat dehydrated.

After removing flowers, rinse stems in clean water and transfer to a solution of water and commercial flower food. This will bring up the remaining dye within the stems and allow the dye to diffuse evenly into the petals.

Dye solutions can be used more than once. It is important to filter the solution after each use. Saps and oils leach into the dye solution from the freshly cut stems. Together with leaves, dirt and other impurities they become food sources for bacterial formation. Good filtration can remove much of these contaminants.

Food strainers and large coffee filters are inexpensive and readily available. The higher the mesh number, the better the filtration. Some companies even filter their dye solution before it is used to remove any undissolved solids that could possibly hinder uptake.

Even though filtering the dye solution extends its useful life, the solution becomes less effective with each successive use. How many times a dye solution can be used depends on the flower, water quality, rate of bacterial formation etc. Solutions in question can easily be tested for viability by first dyeing a few test flowers. Dye solutions not being used should be kept in closed containers to prevent evaporation and contamination. Storing tint solution in the cooler also preserves freshness.

The Dyeing Process

Vase-Life of Dyed Flowers



A simple experiment can be made to monitor the vase life of tinted flowers.

Color Concepts



Tinting white genistra with Sky Blue and Hot Pink.

Our experience has been that dyed flowers generally experience no difference in vase life.

This is supported by university tests reported by Holley and Baker [Ref 1]. The practice of dyeing flowers has been going on since the late 1960s. It is reasonable to conclude from the continued practice over 40 years that tinted flowers suffer no appreciable difference in longevity. The exception is to flowers that are grossly overdye. Certain surfactants can also be phytotoxic.

A simple longevity test can be made by retaining samples of both dyed and undyed flowers from the same lot (same farm, harvest date, etc.). Several stems of each are kept in vases and observed under identical storage conditions.

The final color of dyed flowers depends upon the natural color of the flower, the color of the dye and the amount of dye absorbed. White flowers achieve colors characteristic of the dyes used to tint them. Off-white flowers result in a blend. For example, yellow sunflowers dyed red look orange.

The same dye used to dye four different flowers will likely produce four different colors. Unlike paints (which use pigments, not dyes), there is no white dye. The “white” in a color blend must come from the flowers. Thus pastel shades require flowers that are white or very lightly colored.

Intense shades like red and black are difficult to achieve. Since red is a primary color, a true red requires a white flower. However, the white in the flower tends to give a pink cast. Stronger dye solutions and extra uptake are required. Care must be taken not to over-dye resulting in a loss of vase life.

Absorption dyes can be blended with each other to create custom colors.

The table on page 14 gives some important color concepts.

REFERENCES

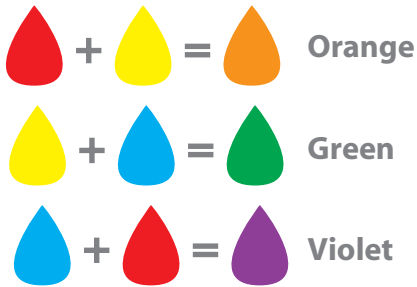
- Ref 1 W.D. Holley, Ralph Baker, 1991 *Carnation Production II*; Kendall/Hunt Publishing Company, Dubuque, Iowa
- Ref 2 Joanna Nowak, Ryszard Rudnicki, 1990 *Postharvest Handling and Storage of Cut Flowers, Florist Greens and Potted Plants*; Timber Press, Inc.
- Ref 3 Alan B. Stevens, 1997, *Field Grown Cut Flowers, A Practical Guide & Sourcebook*, Avatar's World, Edgerton, WI



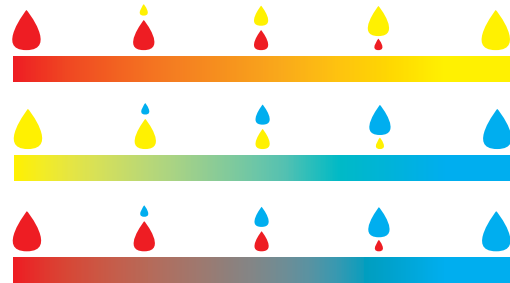
Primary Colors



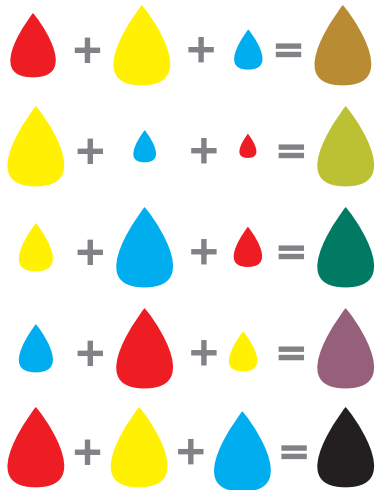
Mixing Primary Colors
Creates Secondary Colors



The Resulting Color depends
on the Relative Proportions

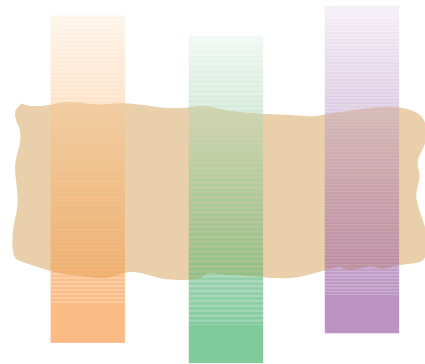


Adding the Missing Primary
To a Secondary Color
Creates a Tertiary Color

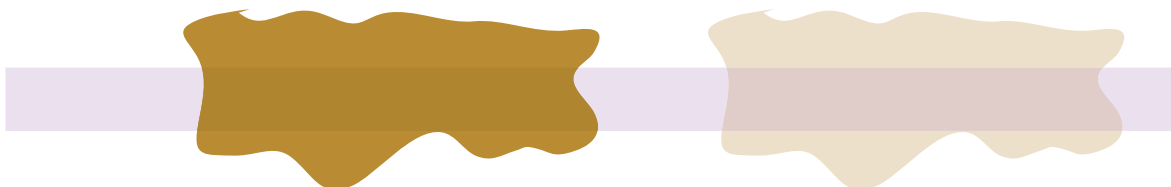


When a material is dyed, the final
color depends on

- the color of the dye,
- amount of dye applied
- natural color of the undyed material



Unfortunately, there is no such thing as a white dye. The white must come from the material being dyed. This is why dark materials cannot be dyed pastel shades.



Absorption Floral Dye Color Chart / Carta de Colores para Tinturas Sistémicas

For Systemic Dyeing of Fresh Flowers & Foliage / Para Teñir Flores Frescas y Follaje por Absorción

Rich Pomegranate 2537	Cherry Red 2515	Crimson 2511	Cinnabar 2508	Brilliant Red 2520	Red 2214	Christmas Red 2506	Cardinal Red 2507
Baby Pink 2100	Light Pink 2105	Dusty Rose 2216	Pink 2214	Shrimp 2240	Cotton Candy 2218	Hot Pink 2880	Bubble Gum 2881
Corral Peach 2503	Peach 2500	Sonia Rose 2250	Pastel Peach 2498	Golden Sunset 2514	Bittersweet 2205	Burnt Orange 2249	Brilliant Orange 2279
Tangerine 2247	Orange Fire 2268	Orange 2248	Sunrise Orange 2244	Lemon Yellow 2374	Brilliant Yellow 2371	Yellow 2375	Golden Yellow 2512
Butterscotch 2610	Champagne 2602	Saffron 2603	Basil Oak 2776	Lime Green 2315	Spring Green 2762	Chartreuse 2300	Leaf Green 2337
Desert Green 2907	Olive Green 2314	Basil 2316	Seafoam 2383	Mint Green 2312	Christmas Green 2301	Kelly Green 2302	St. Patrick's Green 2792
Foliage Green 2767	Victorian Green 2307	Dark Green 2784	Moss Green 2785	Hunter Green 2311	Deep Hunter Green 2764	Forest Green 2309	Deep Forest Green 2763
Statice Green 2777	Jade 2318	Avocado 2304	Aqua 2910	Turquoise Green 2306	Cyan Green 2334	Teal 2320	Blue Lace 2321
Light Blue 2386	Ice Blue 2323	Raleigh Blue 2657	Sky Blue 2388	Blueberry 2662	Royal Blue 2650	Wedgwood 2350	Blue Bonnett 2670
Colonial Blue 2296	Steel Blue 2297	Williamsburg 2299	Heritage Blue 2298	True Blue 2659	Cobalt 2384	Navy Blue 2661	Fuchsia 2219
Cranberry 2510	Magenta 2211	Burgundy 2222	Mulberry 2886	Hot Fuchsia 2888	Lilac 2210	Pomegranate 2518	Mauve 2751
Plum 2139	Hot Violet 2215	Brilliant Violet 2206	Orchid 2225	Loganberry 2209	Hot Lavender 2201	Lavender 2200	Easter Lavender 2226
Imperial Purple 2191	Brilliant Purple 2203	Satin Purple 2648	Concord Grape 2155	Deep Purple 2193	Autumn Bronze 2401	Root Beer 2402	Light Brown 2399
Cinnamon 2413	Cinnamon 2407	Brown 2400	Rich Brown 2411	Black 2012	Charcoal Black 2001	Gray 2291	

Colors shown are CMYK approximations only. Actual colors may vary depending upon concentration and the nature of the product to which these dyes are applied.

2013 Absorption Floral Dye Color Chart series v1



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CAUTION: Dyes and chemicals may cause skin and eye irritation. Wear rubber gloves, safety glasses, protective clothing and a NIOSH approved dust mask when using these products. In case of skin contact, wash with soap and water. Refer to the Material Safety Data Sheet(s) (MSDS) prior to use for complete information. Dyes may stain skin, clothing and work surfaces. Handle carefully to avoid spills.