

# Color Matching for Instant Release Coated Tablets

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## Introduction

Color plays an important role in the development of solid oral dosage forms. Considering the pharmaceutical drug safety of tablets, fast identification of tablets not only by shape and size but color is of great advantage. Although patients prefer small white tablets, colored tablets increase drug safety and patient compliance [1]. Often tablets with the same drug but varying strength are of different color to help patients to distinguish between them. Especially for elderly patients with multidrug treatment differentiation of tablets by color is enhanced. Furthermore the psychological effect of colors can increase the drug efficacy [2]. From a marketing point of view the recognition value of a color can be used to create a special brand. The new product range of Kollicoat® IR Coating Systems, consisting of 7 ICH-approved base colors, has been designed to facilitate convenient and short production of instant release coated tablets of a certain color [3], by mixing the different base colors at the production plant. The coating systems are composed of the film forming polymer Kollicoat® IR, a PEG-PVA grafted copolymer [4], pigments and further additives. As an integral part a software has been developed that enables color prediction of mixtures of the different base colors.

The goal of this study was to investigate the potential to produce tablets of a certain color using the Kollicoat® IR Coating Systems in combination with color matching function based on an algorithm of the colorimetric data of the base colors. The evaluation was performed by color matching marketed products.

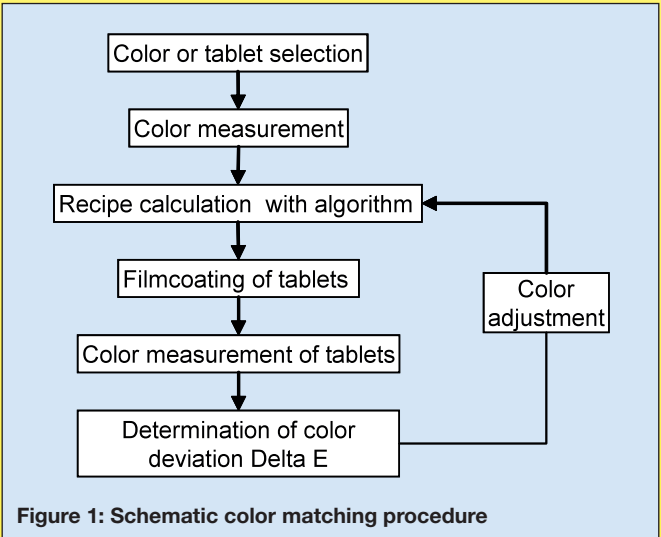
## Materials and Methods

### Materials

Instant release colored coating systems Kollicoat® IR White II, Kollicoat® IR Yellow, Kollicoat® IR Red, Kollicoat® IR Carmine, Kollicoat® IR Sunset Yellow and Kollicoat® IR Brilliant Blue (BASF SE, Germany) were used as coating material. The coloring pigments are titanium dioxide, iron oxide yellow/red, and the aluminum lakes Carmine, Sunset Yellow and Brilliant Blue respectively. Core formulation of the tablets was 99.5 % Ludipress® LCE (BASF SE, Germany) and 0.5 % magnesium stearate (Baerlocher GmbH, Germany).

### Methods

First step in the color matching procedure was to determine the color of 10 tablets of different color shade by colorimetric evaluation (Datacolor 400, Datacolor, USA). Based on the obtained L\*a\*b\* values recipes for color matching were calculated with the aforementioned algorithm. The color of tablets coated with the suggested formulations was determined and the color deviation was evaluated. For color adjustment the recipes were adapted (see Figure 1).



The experimental setup for colorimetric evaluation was: aperture USAV, light source d65 and observer angle 10°. The colorimetric values were recorded as L\*a\*b\* values of the CIELAB color space and color deviation was calculated by determining the Delta E value as displayed in equation (1).

$$\Delta E = \sqrt{(L^*_1 - L^*_2)^2 + (a^*_1 - a^*_2)^2 + (b^*_1 - b^*_2)^2} \quad (1)$$

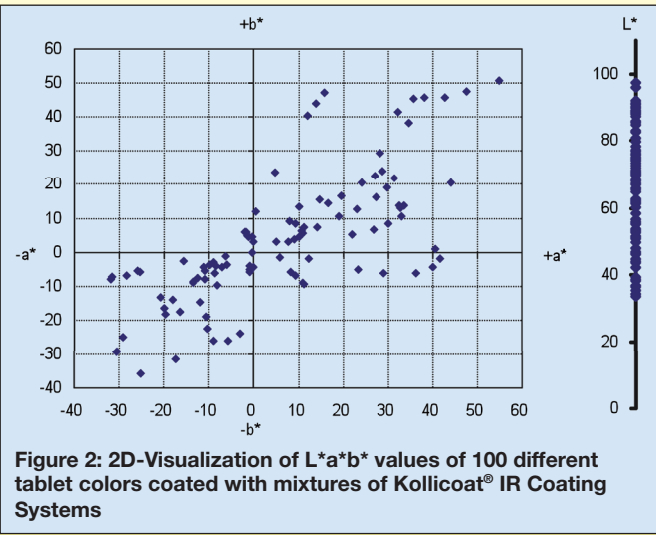
### Film Coating

Tablets were coated using a fluid bed coater with a central rotating spraying nozzle (Ventilus IEV1, INNOJET Herbert Hüttlin, Germany). Aqueous film coating suspensions with

20% solids content were prepared by redispersion of mixtures of the Kollicoat® IR Coating Systems in water. For the film coating trials a batch size of 150 g was used and the coating level was set to 3.2% weight gain (4.9 mg/cm<sup>2</sup>).

## Results and Discussion

By simply mixing the different colored Kollicoat® IR Coating Systems a large color space is accessible, exemplarily shown for 100 colors in Figure 2.



For testing the color matching 10 tablets of different color shades were selected. The colorimetric data were used (see Table 1) to calculate the recipes for the color matching (see Table 2). Those recipes with the smallest variation of base colors were selected.

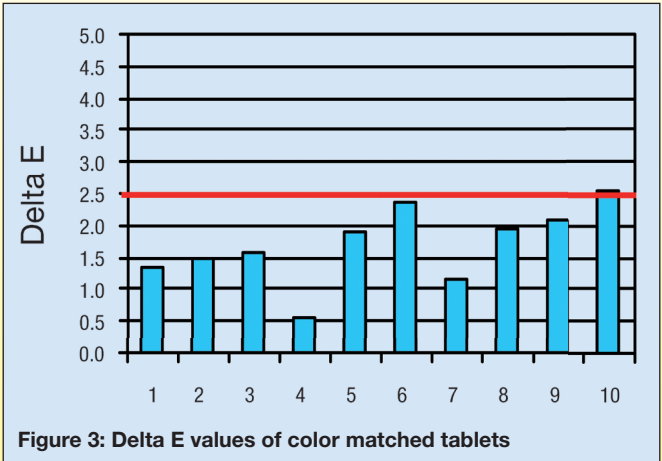
Tablet	Color	L*	a*	b*
1	YELLOW	81.0	14.1	28.5
2	YELLOW	74.7	12.4	40.7
3	ORANGE	72.6	24.9	21.4
4	YELLOW	92.4	3.5	23.3
5	ROSE	88.7	11.4	8.9
6	RED	65.6	27.0	19.9
7	RED	88.6	8.4	10.8
8	GREEN	74.9	-7.7	7.1
9	BLUE	75.4	-8.1	-18.7
10	BLUE	69.4	-7.3	-21.7

Table 1: Colorimetric data of 10 tablets

Tablet	Kollicoat® IR					
	White II [%]	Yellow [%]	Red [%]	Sunset Yellow [%]	Carmine [%]	Brilliant Blue [%]
1	85.0	14.0	1.0			
2	50.0	49.6	0.4			
3	87.2	4.6	5.5	0.5		
4	95.7	4.3				
5	97.3	1.7		0.2	0.8	
6	75.0	11.5	13.5			
7	98.5	1.0	0.5			
8	88.3	9.5			1.3	1.0
9	98.4				0.9	0.7
10	92.5				4.5	3.0

Table 2: Recipes for color matching

Evaluating the L\*a\*b\* values of the matched tablets, color deviations below a Delta E of 2.5 were observed (see Figure 3). This color deviation is usually not detectable by the untrained eye, when applied to the relatively small dimensions of a tablet. Furthermore even within one batch of coated tablets, color differences of up to a Delta E of 3 were detected (data not shown).



The color matching procedure is an iterative process, therefore generating a matching recipe within the first cycle is an excellent result. To show the effect of adjusting the recipe, a color matching process in two steps is exemplarily shown in Table 3. Evaluation of the L\*a\*b\* values showed lowering the red and yellow pigment content reduced the Delta E. Exchanging Kollicoat® IR Red by Kollicoat® IR Sunset Yellow in the recipe further reduced the Delta E from 2.0 to 1.3.

a)				
	L*	a*	b*	D E
Tablet	89.9	8.2	18.4	0.0
Recipe 1	88.1	9.2	19.0	2.2
Recipe 2	89.7	6.9	16.9	2.0
Recipe 3	90.4	8.8	19.5	1.3

b)			
Kollicoat® IR	Recipe 1	Recipe 2	Recipe 3
White II	95.6	96.7	96.7
Yellow	4	3	2.9
Red	0.4	0.3	0
Sunset Yellow	0	0	0.4

Table 3: Refinement of color matching

## Conclusion

The product line of Kollicoat® IR Coating Systems enables color matching of tablets. In combination with a BASF-proprietary algorithm a fast and economical color matching procedure is possible. Due to the large accessible color space a desired colored can be prepared by the combination of the different Kollicoat® IR Coating Systems.

## References

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