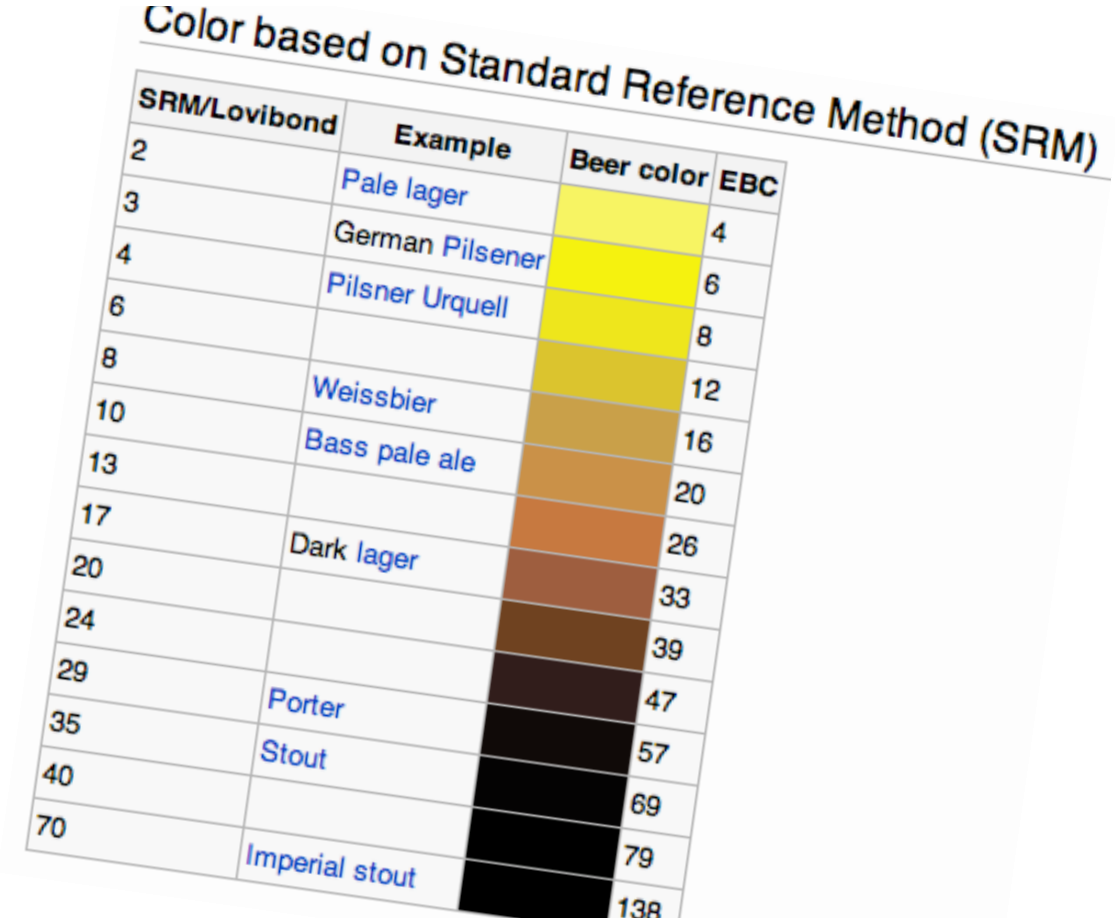
BEERCOLOR

November 13, 2008

Beer color has fascinated mankind since the first time someone thought about drinking an old yeasty soup made out of malted barley with some hops thrown in for good measure. Tonight, our mission as color scientists and engineers is to perform careful (careless?) psychophysical analyses of the correlation between beer color, taste, and effect.

This short handout/ presentation is simply to amuse you and provoke some thoughts on the colorimetry and spectrophotometry of beer.

Image to right from wikipedia.com



Industry Standard Practices
SRM & EBC

ASBC SRM

The American Society of Brewing Chemists (ASBC) has created a standard method for beer color specification known as the Standard Reference Method (SRM).

SRM is determined by measuring the ***absorbance*** of the beer at a wavelength of ***430nm*** with a ***1/2"*** path length. The absorbance is then multiplied by 10 to obtain the SRM value (sometimes referred to as degrees Lovibond, °L).

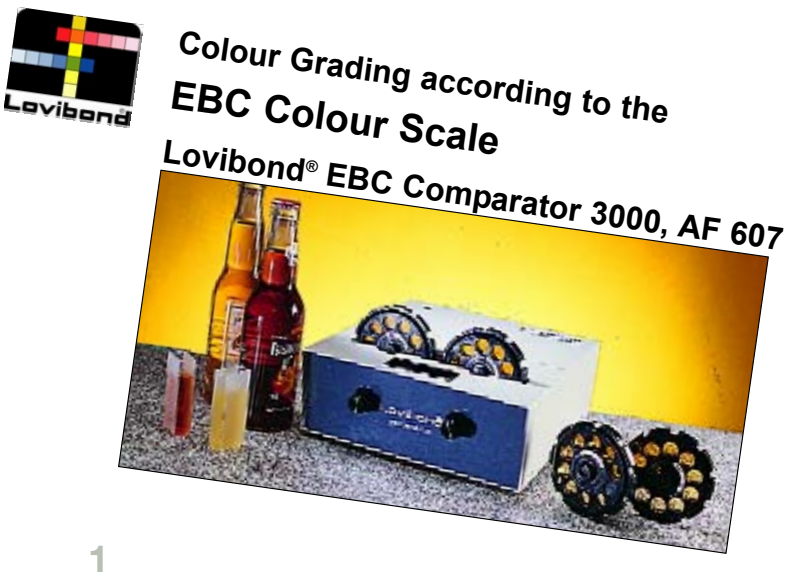
EBC

The European Brewing Convention (EBC) has a similar method. It is also based on ***absorbance*** at ***430nm***, but with a ***1cm*** path length. For EBC values, the absorbance is then multiplied by 25.

Conversion. Since both metrics are based on absorbance at 430nm, conversion can be made by simply adjusting for the differences in path length and multiplicative factors. Thus the conversion is ***EBC = 1.97SRM*** or ***SRM = EBC/1.97***.

There was an older EBC metric based on absorbance at 530nm. Conversion between the old EBC and SRM metrics required a nonlinear approximation.

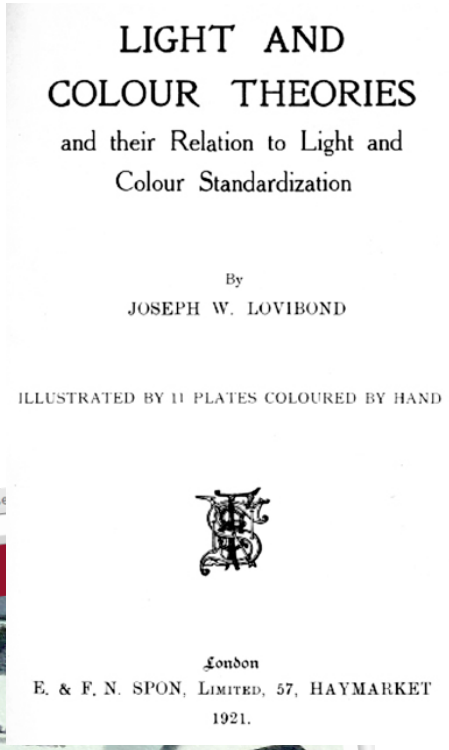
The figure above provides some rough guidance on SRM and EBC values for typical brews.



Beer-Color Dimensionality?
Mononumerosis Again?

The EBC and SRM methods naturally beg the question "can beer color be well described with only one variable?"

In tribute to Joseph Lovibond, the brewer who is credited with inventing the visual colorimeter, the author has spent years collecting beer samples and measuring them (1cm path) with a trichromatic (CMY) Lovibond Tintometer available at the RIT-MCSL


LIGHT AND COLOUR THEORIES

and their Relation to Light and Colour Standardization

By

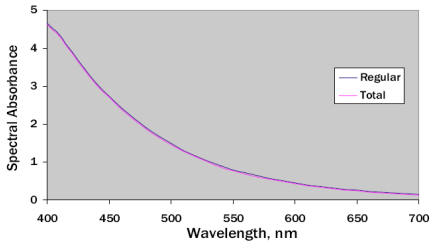
JOSEPH W. LOVIBOND

ILLUSTRATED BY 11 PLATES COLOURED BY HAND

London

E. & F. N. SPON, LIMITED, 57, HAYMARKET

1921.



re 5.1.: The Absorbance spectra for the Kasteel Bruin beer, measured in both ' and Regular modes. That the two spectra are nearly identical indi low scattering. (Because this plot is in Absorbance, the Regular spect should appear above the Total, which it does, however slightly.)

ABOVE: ***Example spectral absorbance of beer (from Viggiano)***
This Interlude on Beer Color brought to you by Mark Fairchild of the RIT Munsell Color Science Labboratory (mdf@cis.rit.edu)

Beer's Law?

The problem, ultimately, is that – incredible as it may seem – beer does not always follow Beer's Law. . . . Over the years, several authors have asserted that beer obeys Beer's Law. Unfortunately, these studies appear to have examined a very limited portion of the beer color universe. It appears that Beer's Law does hold for beers with a final color of less than 5 or perhaps 10 SRM. [Daniels ... referenced by Viggiano] *You can't dilute Guinness to make a lager. -MF*

Evolution of the Method.

The writer was formerly a brewer, and this work had its origin in an observation that the finest flavour in beer was always associated with a colour technically called "golden amber," and that, as the flavour deteriorated, so the color assumed a reddish hue. It was these variations in tint that suggested the idea of colour standards as a reliable means of reference.

Joseph W. Lovibond

The online database has been growing for years and the data were finally put to use to answer the dimensionality question. The CMY measurements for over 100 brews are plotted below. Principal Components Analysis was performed and the ***percent of variance*** explained by each of the three dimensions was ***85%***, ***14%***, and ***1%***. It appears that two dimensions are required. Analysis of the characteristic vectors shows that the first dimension is ***light-dark***, the second ***yellow-blue***, and the third ***red-green***. This follows opponent theory, but puts more emphasis on yellow-blue.