



Naturalized dyes: physico-chemical characterization and biotechnological purification of their dyeing effluents

Silvia Fogli*, Silvia Tilli, Roberto Bianchini

*silvia.fogli@unifi.it

Department of Chemistry «Ugo Schiff» University of Florence

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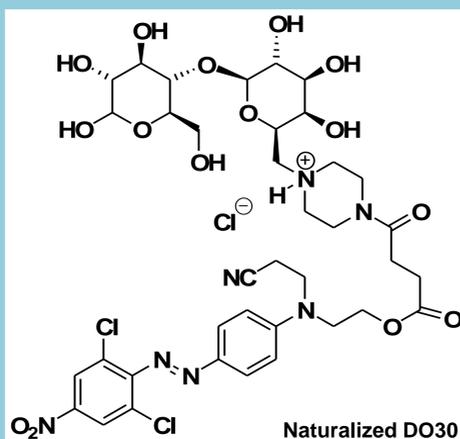


Biokimica Group (IT)

Dr. Alessandro D'Ulivo
Chemistry Institute of
Organometallic
Compounds of CNR (IT)
dulivo@pi.iccom.cnr.it

www.lifebionad.com**Abstract**

The last decades have seen an increase of environmental issues leading to a growing request for greener products in many fields, including dyeing industries. Currently used dyeing processes require the use of massive quantities of additives, such as surfactants and salts to guarantee a good result. Thus, it is mandatory to find a way to reduce or eliminate these pollutants from dyeing processes. Naturalized dyes could be a valid alternative to the currently used dyes. They are synthesized conjugating a lactose unit to a selected chromophore. These dyes can be employed in standard dyeing processes without using additives, resulting in a lower environmental impact. However, conjugating the lactose to the hydrophobic chromophore gives an amphiphilic character to these dyes, resulting in self-assembled structures in solution. This behaviour resulted very important when concerning their biotechnological purification. When these solution were treated with the white-rot fungus, *Funalia Trogii*, it came out that the mixture was better removed from the solution than the single dyes, indicating an interaction. Thus, a physico-chemical characterization of these dyes was addressed, in order to better understand the characteristics and the possible applications of these new class of compounds.

Methods

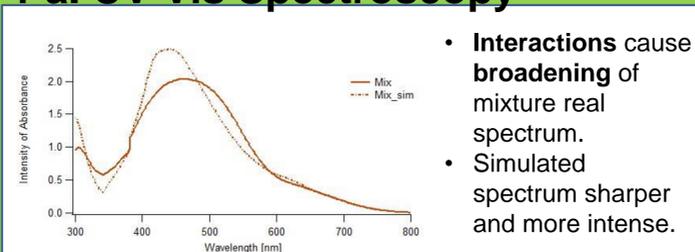
Four dyes and their 1:1:1:1 mixture (MIX) were studied:

- Naturalized disperse yellow 42 (DY42)
- Naturalized disperse orange 30 (DO30)
- Naturalized disperse red 202 (DR202)
- Naturalized disperse blue 27 (DB27)

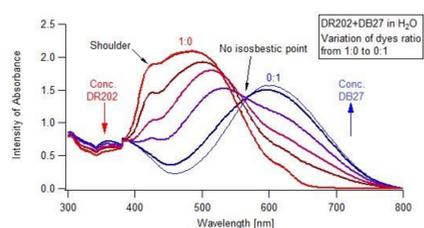
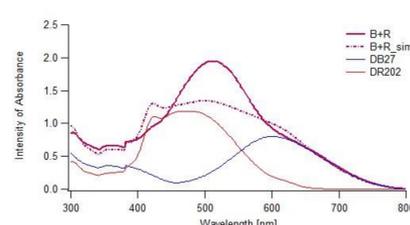


1. These dyes were characterized from a **physico-chemical** point of view using:
 - a. UV-Visible Spectroscopy
 - b. Dynamic Light Scattering

2. **Biotechnological purification** performed using *F. Trogii* in different conditions:
 - Fungal biomass alone
 - Fungal biomass with 10 g/L glucose
 - Dead fungal biomass

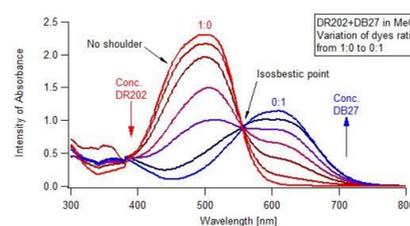
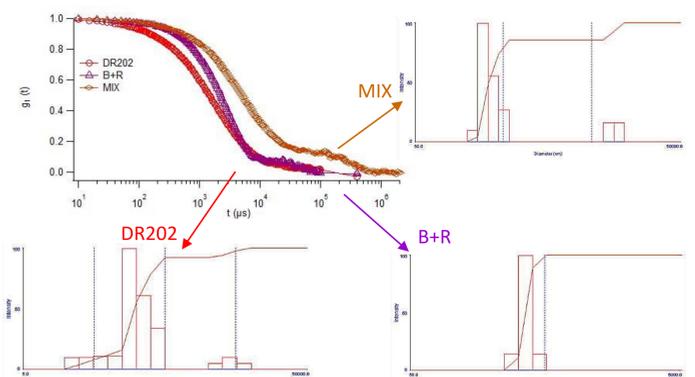
Results**1 a. UV-Vis Spectroscopy**

Interaction between DR202 and DB27 causes **breaking** of pre-formed structures leading to **higher intensity** of absorbance.

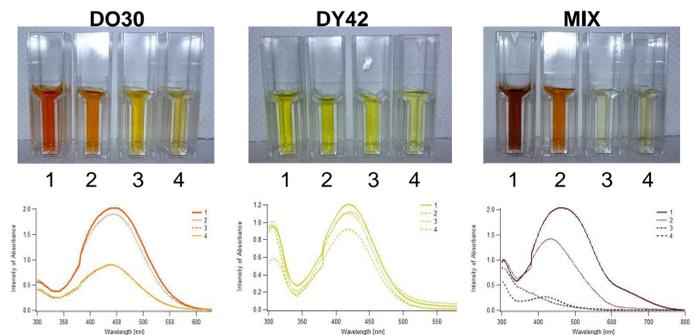


- **No isosbestic point** in H₂O thus **interaction** between the dyes.
- Shoulder on DR202 two self-assembled structure.

- **Isosbestic point** in MeOH thus **no interaction**.
- No shoulder in DR202 only one aggregation structure.

**1 b. Dynamic Light Scattering**

- More than one population in solution.
- **Relaxation time and dimensions** of the aggregates increase passing from DR202 < B+R < MIX

2. Biotechnological purification

Legend:

1. Untreated sample
2. *F. Trogii*
3. *F. Trogii* + glucose
4. Dead *F. Trogii*

- **Low colour removal** for DY42 and DO30 alone upon fungal treatment.
- **MIX almost completely removed** from the solution. This indicates interaction between dyes.

Conclusions

- Naturalized dyes form self-assembled structures in water but not in MeOH.
- Presence of population of different dimensions.
- The interaction between dyes facilitate the colour removal using biotechnological techniques.

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