Vom Antiken Purpur über historische Indigofarbstoffe zu Ozondetektor und Solarzelle

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Indigoide: Strukturen, Kuepenfärbung

Indigoide: farbig, schwerlöslich
X = H: Indigo
X = Br: 6,6'-Dibromindigo

leuco Verbindungen (Kuepen)
hellgelb, wasserlöslich

Reduktion  <->  Oxidation
I can tell you how history is made, or I should say, “made up.” Back in 1961 I repeated here what I thought was a joke about Alexander the Great and his invention of the first wristwatch. It consisted of a chemically treated cloth worn on the left forearm. Under the heat of the sun, the cloth changed colors each hour. It was known as “Alexander’s Rag Timeband.”

Since then my anecdote has become an integral part of the lore of a fairly new science known as “photochromism.”
Natürliche Vorstufen von 6,6'-Dibromindigo

Tyrindoxyl sulfate → Tyrindoxyl → Tyrindoleninone

Tyrindoxyl sulfate → Tyrindoxyl → Tyrindoleninone → 6,6'-Dibromindigo

Tyriverdin → 6,6'-Dibromindigo
Debromierung des Tyrischen Purpurs (Farbwechsel zu blau)

6,6'-Dibromindigo, schwerlöslich, *purpurfarben*

Reduktion in H₂O → *leuco* 6,6'-Dibromindigo, wasserlöslich, hellgelb

Red.mittel. Sonnenlicht Wasser

Indigo, schwerlöslich, *blau*

*leuco* Indigo, wasserlöslich, hellgelb

Oxidation
Dehalogenierung von Indigoderivaten in $\text{D}_2\text{O} \Rightarrow \text{C-deuterierte Indigos}$

verschiedenfarbig → alle blau

1. Reduktion in $\text{D}_2\text{O}$, 2. Sonnenlicht, 3. Reoxidation

Indigoide in der Photovoltaic:
Publikationen 2011/12 (N.S. Saricifci et al., LIOS)

* Indigo and Tyrian Purple –
  From ancient natural dyes to modern organic semiconductors
  *Israel Journal of Chemistry*, accepted, in press.

* Exotic materials for bio-organic electronics
  *Mater. Chem.* **2011**

* Natural and Nature Inspired Materials for Organic Solar Cells
  *Adv. Materials*, **2011**

* Ambipolar organic field effect transistors and inverters with the natural material Tyrian Purple
  *AIP Advances*, **2011**

*Indigo – A Natural Pigment for High Performance Ambipolar Organic Field Effect Transistors and Circuits

* Vacuum-processed polyethylene as a dielectric for low operating voltage in organic field effect transistors
  *Organic Electronics*, **2012**
Cibalackrot - Herstellung, Eigenschaften

![Chemical structures](image)

\[ \text{Cibalackrot} \]

1914, Engi, Angew. Chem.,  Fluoreszenzquantenausbeute 0.90, Fluoreszenzlebensdauer 5.8 ns in Decalin, 20 °C. Hauke 1979

A picture of a simple diode with cibalackrot as the transporting and emitting material. It's a 10x10mm pixel emitting orange light. Single layer OLEDs are rare. LIOS 2012
Cibalackrot OLED


**Reaktion von Indigo mit Ozon zu Isatin**

Fig. 7 Change of the absorption spectrum of 5 (a) and 9 (b) during exposure to 0.1 ppm ozone. Spectra were recorded at regular intervals of 120 s (5) and 900 s (9). T = 23°C, RH < 4%, V = 1,000 mL min⁻¹, c = 0.1 ppm, t = 4 h (a) and 12.5 h (b), C = 4 wt.% (a) and 6 wt.% (b), d = 580 nm. T temperature, RH relative humidity, V gas flow, c gas concentration, t exposure time, C dye reagent concentration in the polymeric film, d thickness of the polymeric film with immobilised dye reagent.
Glycoside; Indigo; Naturstoffe; Tumorthherapeutika

**Himmelblaue Akashine** (siehe Bild) sind die ersten aus einem terrestrischen Streptomyceten isolierten natürlichen Derivate von 5,5’-Dichlorindigo und die ersten Indigoglycoside überhaupt.


Polymeric Colorants: Staqtistical Copolymers of Indigo Building Blocks with defines Structures,
POLYMERS OF TYPE 2 AND 3 - FUNCTIONAL DYES

POLYMER OF TYPE 2

POLYMER OF TYPE 3

among others

A.A. Berlin et al., Moscow (USSR) around 1970.

H. Tanaka et al., Tokushima (Japan) around 1990.

MATERIAL PROPERTIES:
SEMICONDUCITIVITY
FERROMAGNETISM
(Poly)indigos als Kuepenfarbstoffe:

links: Polyindigo (Typ 2),  
mitte Indigo (1),  
rechts Polyindigo (Typ 3),  
siehe auch u.a.


ALKALINE SOLUTIONS of 2 and 3

AMORPHOUS SOLIDS: POLYMERS 2 (m = 0) and 3 (m = 1)
Danke für die Aufmerksamkeit!