

Insight Denim

Using DyStar[®] Indigo Vat 40% Solution for strong positive impact on resource efficiency and much lower environmental impact



History of Indigo

- Indigo is probably the oldest natural organic dye

- ◆ 3000 BC

- "Vatting trough" lined with stones in the Indus Valley. Indigo found in cracks between the stones.

- ◆ 2000 BC

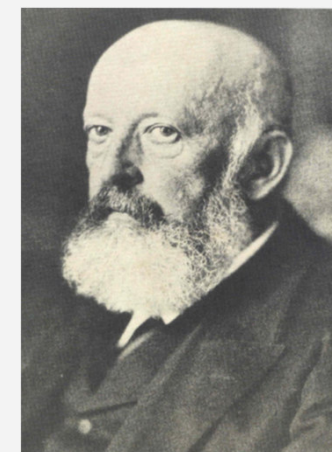
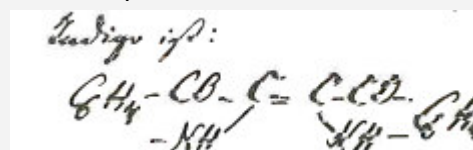
- Sanskrit description of the extraction of Indigo.

- ◆ 1700 - 1900 AC

- Large Indigofera tinctoria in India, South-East Asia and South America [1885: Global output of natural indigo approx. 5,000 t (based on 100 % Indigo)]

- ◆ 1883

- Adolf von Baeyer discovers the chemical structure of Indigo

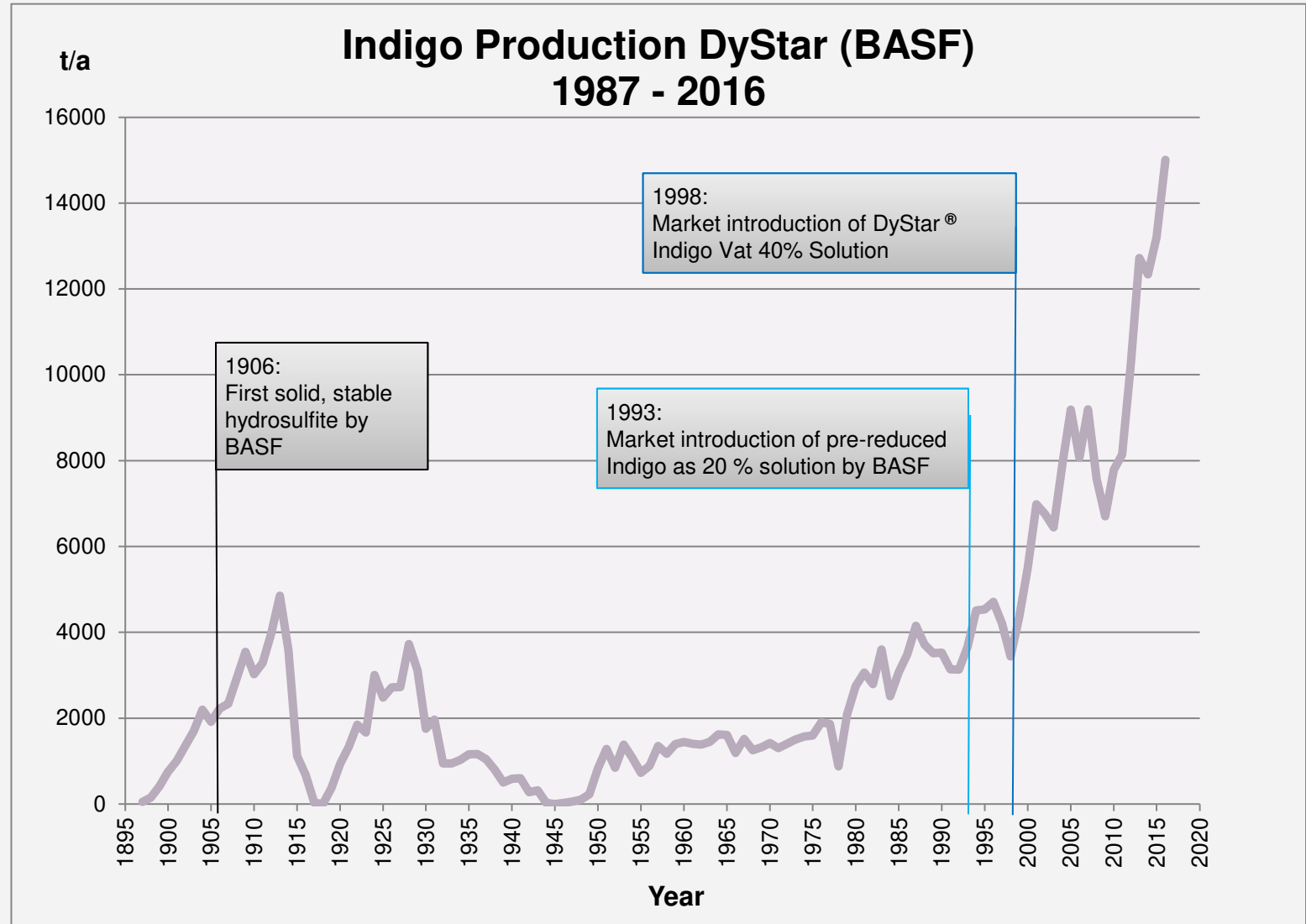
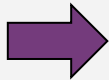


History of Indigo

1885:
~ 5000 t/a
of natural
Indigo



1897:
first
technical
synthesis



What is Indigo?

- a **blue pigment**

- insoluble in water
- no affinity to cotton



→ to allow it to dye cotton, it requires a reduction process

- by reduction, the “**Leuco Indigo**” is formed

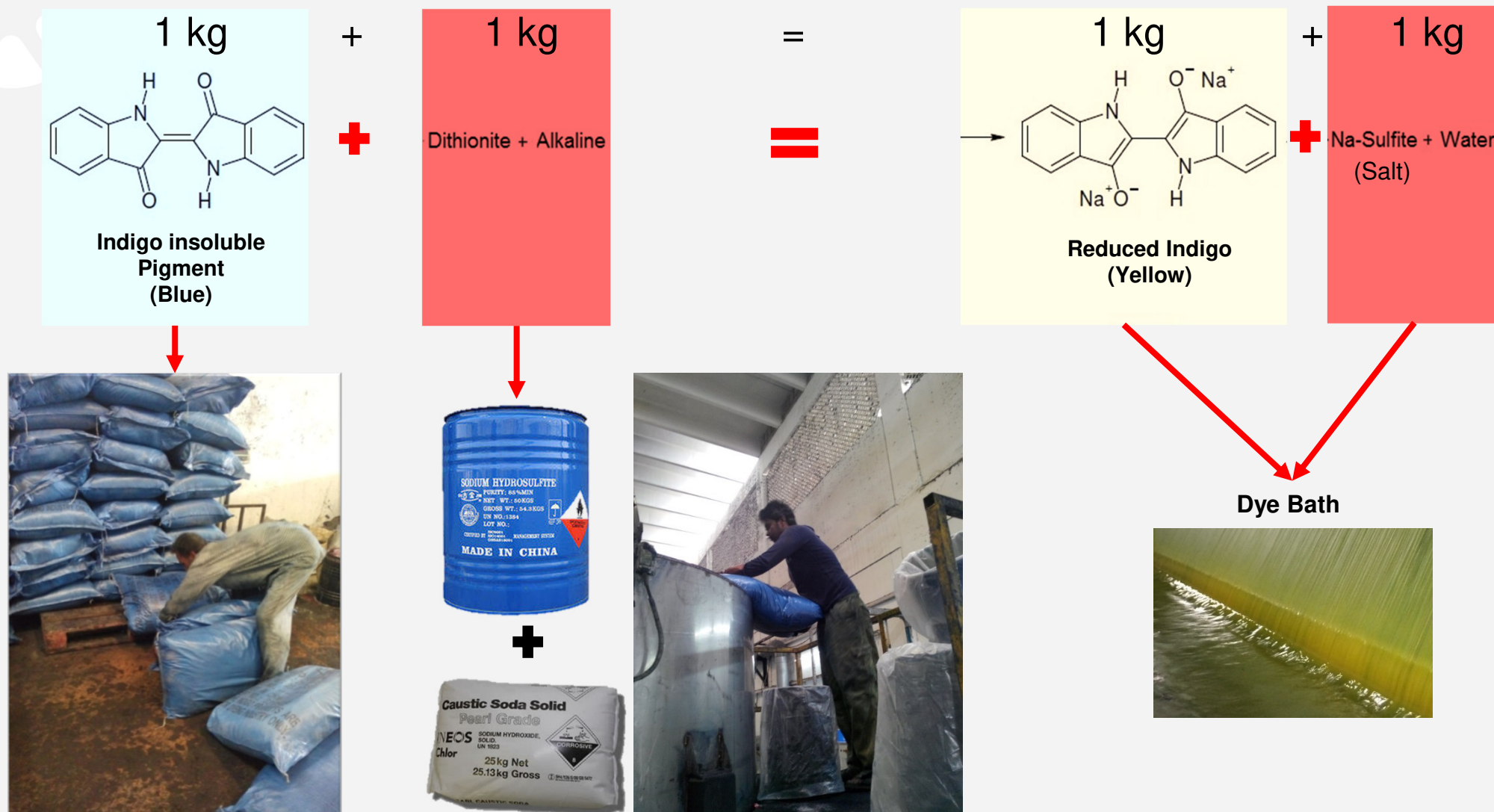
- Soluble in water
- Affinity to cotton
- Oxidizes in the cotton fibre by atmospheric oxygen



- This Leuco Indigo can be achieved in two ways:

- Using Indigo Powder and a reducing agent
or
- Pre-reduced Indigo

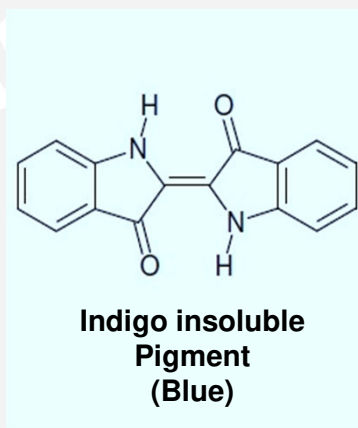
Conventional reduction process with *Hydrosulfite*



Insight Denim – DyStar® Indigo Vat 40 % Solution



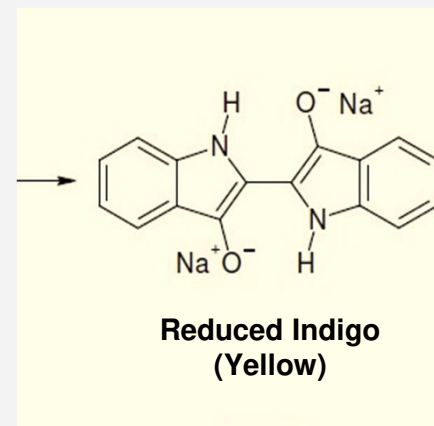
State of the art reduction process of **DyStar Indigo® Vat 40% Solution**



+ H₂ + Alkaline



Ready to use



No Salt!

+ Water



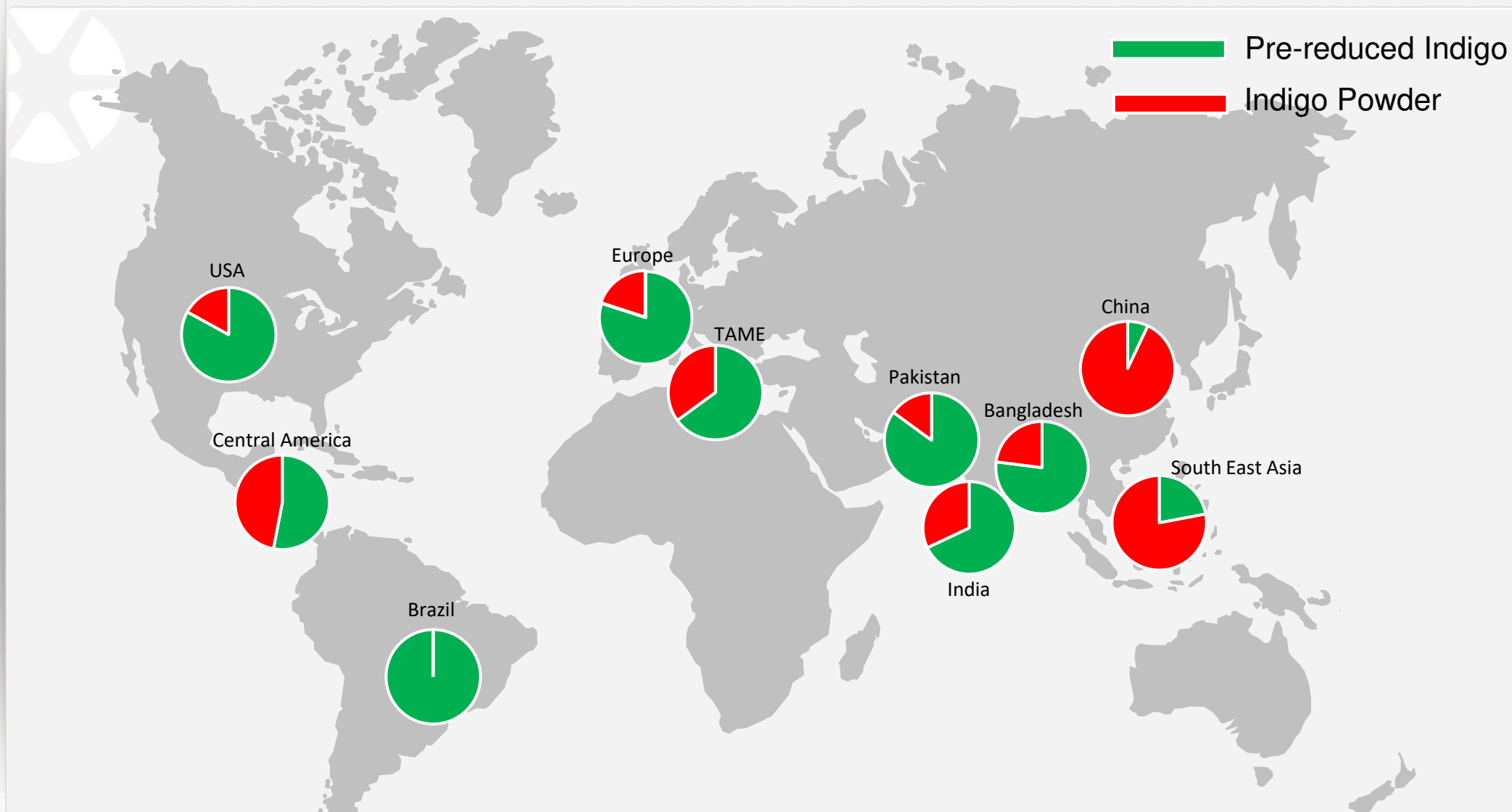
Dye Bath



...Occupational Human and Safety

- More easy (as it is a liquid) and reliable handling.
- No empty indigo drums and less hydrosulphite drums for disposal.
- Substantially less soiling of the dye house and the equipment.
- Humans are not in contact with the product and no dust possible
- Improved occupational hygiene.

Insight Denim – Indigo World Market

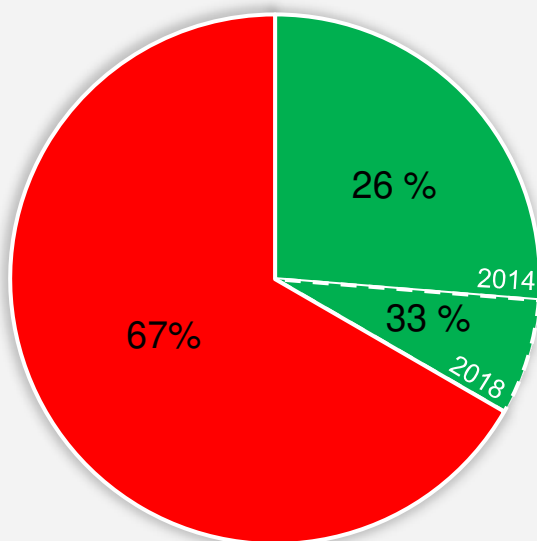


The Indigo world market is about **73.300 t/a** (source DyStar Denim Team 2018)

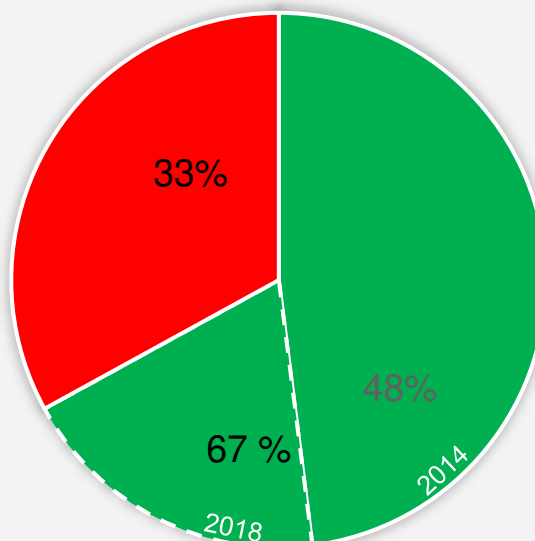
PRI Share 2014 vs. 2018

■ Prerduced Indigo
■ Indigo Powder

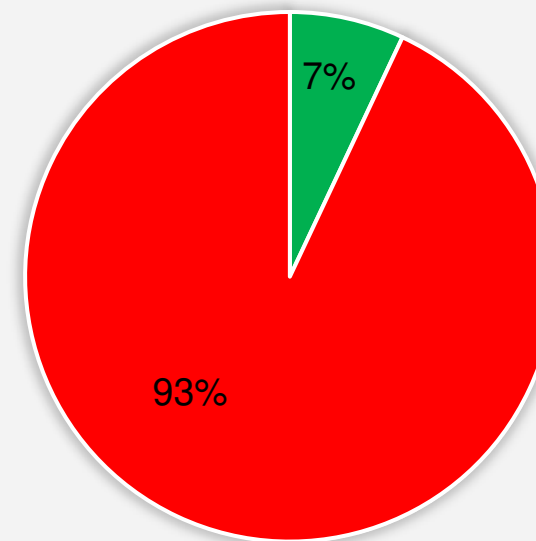
GLOBAL MARKET



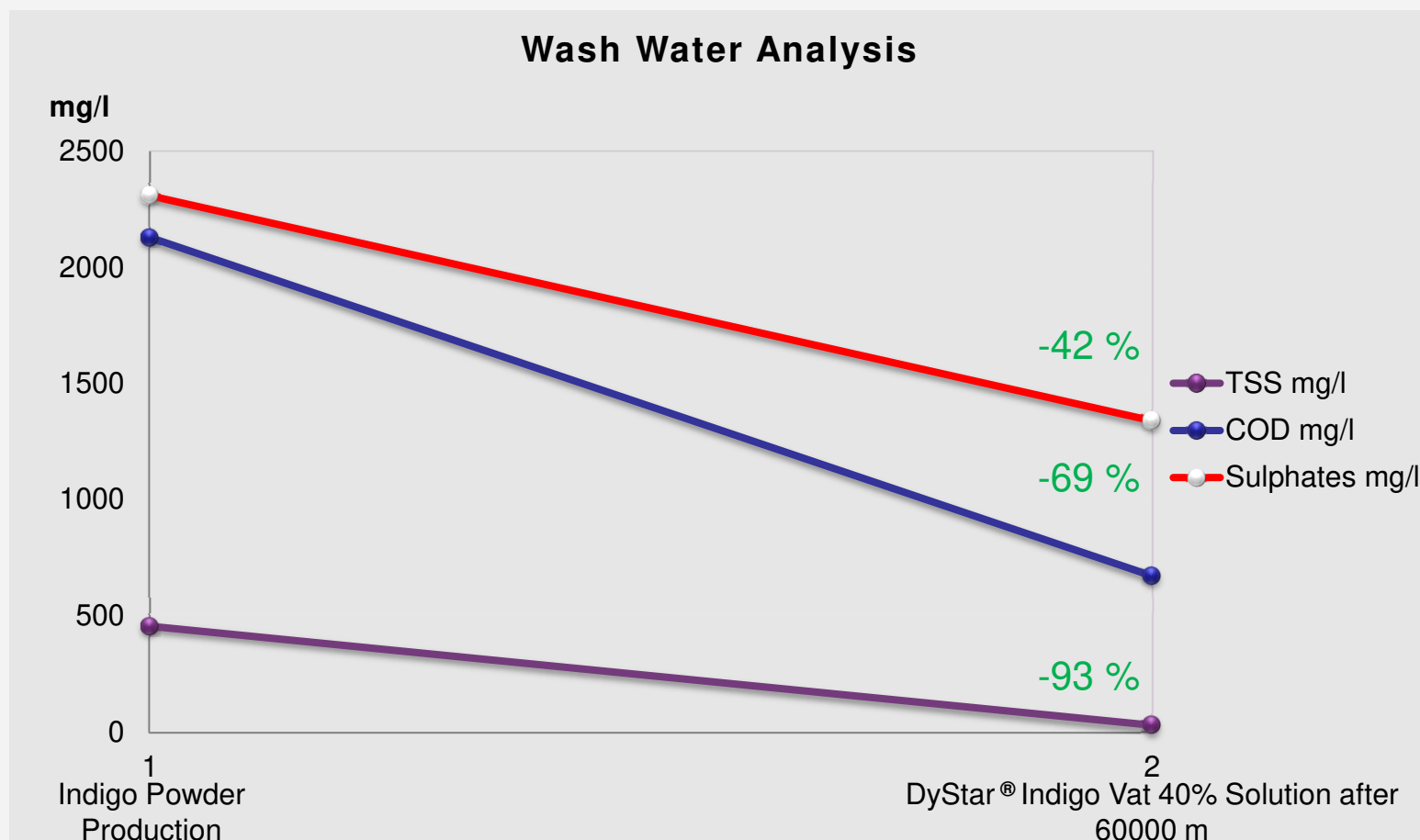
GLOBAL MARKET
EXCL. CHINA



ONLY CHINA
2014 AND 2018



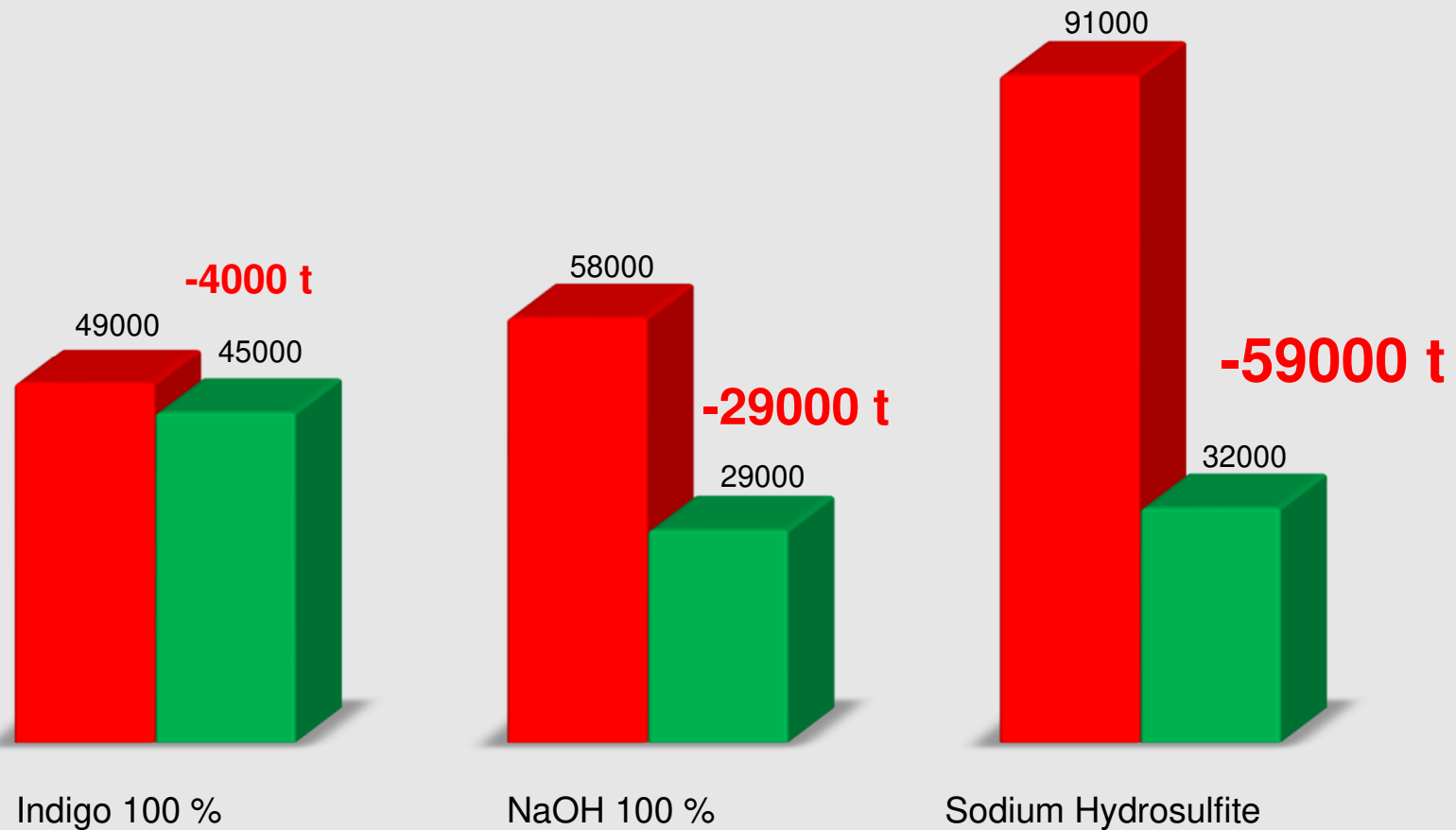
- Analysis of the **wash water** after switching from Indigo Powder to DyStar® Indigo Vat 40 % Solution



Insight Denim – Resource Efficiency Global View

Potential of Ressource Savings

■ Indigo Powder process [t/a] ■ Pre-reduced Indigo process [t/a]



Cadira Denim is the new Indigo dyeing technology to completely eliminate hydrosulphite, which is responsible for the salt formation during the dyeing process.

- More than **65,000 tons** of the conventional reducing agent hydrosulphite are still used in Indigo dyeing per year
- After the dyeing process **65,000 tons** of salt (sulphite and sulphide) contaminating the wastewater effluent and finally need to be landfilled



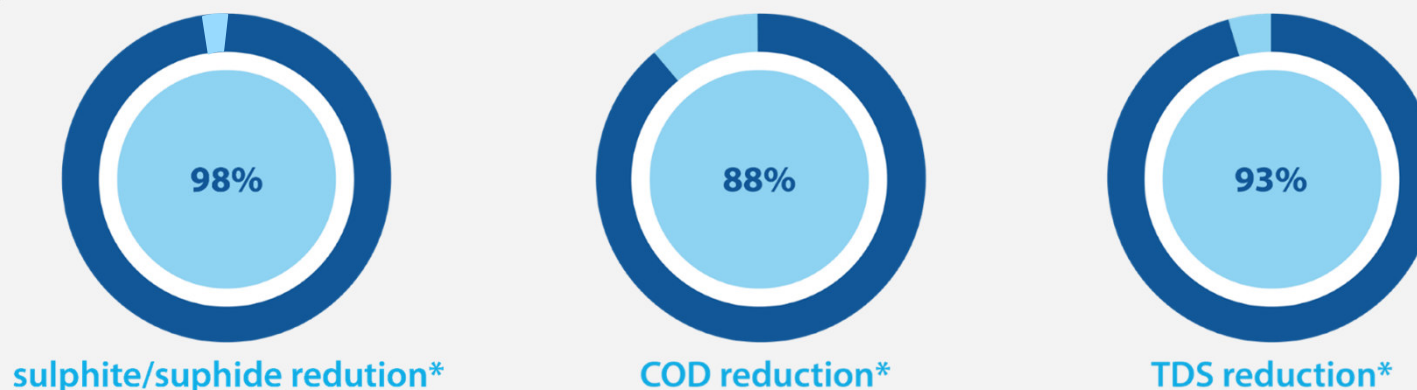
- **It's strong waste and effluent topic**

Customer Case study

● Objective

- ◆ To show the positive environmental impact of the Cadira Denim technology in the effluent treatment plant

● Results

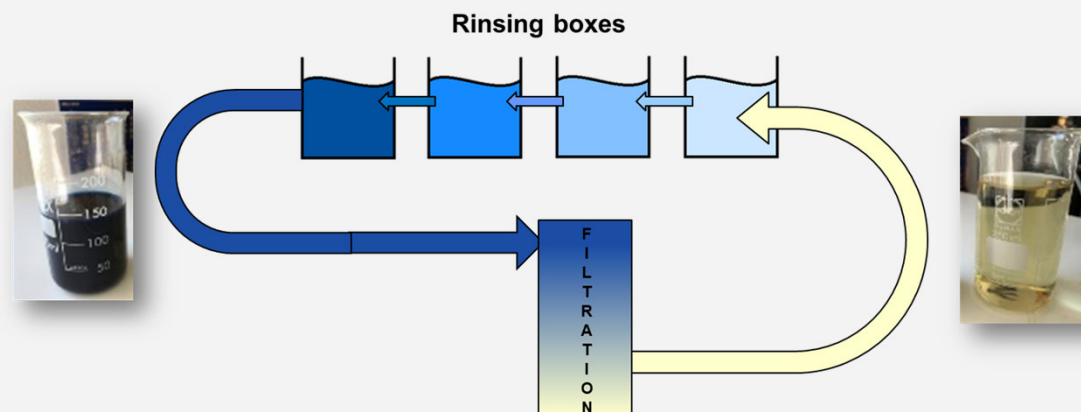


● Conclusion

BEST AVAILABLE TECHNOLOGY at present is Cadira Denim Technology. It eliminates almost completely the salt formation during a Denim dyeing process thus further improves the environmental impact.

*As compared to dyeing with Indigo Powder

- **Recycling of the wash water**



- **Spray dyeing technology in Slasher dyeing machines**



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