

GRATZEL DYE SOLAR CELLS WITH BIXA ORELLANA NATURAL DYE EXTRACT

S. Zongo

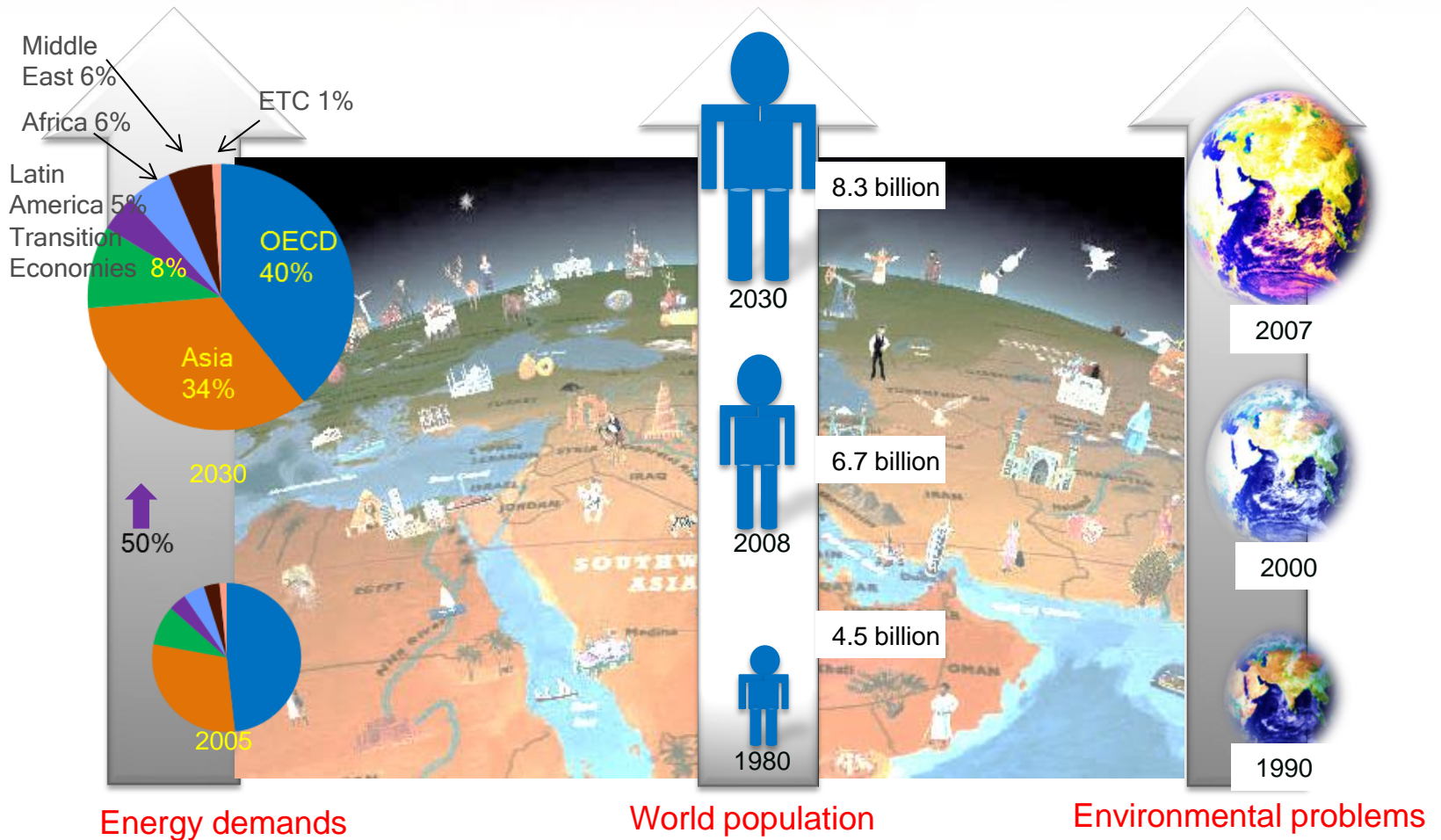




Outline

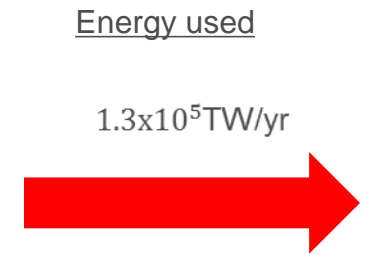
- Context
- Energy supply
- Solar cells and its progress.
- Gratzel DSC
- Bixa Orellana
- Conclusion

Context: Energy future.



Source: [zekai Sen](#); Atmosphere, Environment, Climate change and Renewable Energy.

Solar Energy supply

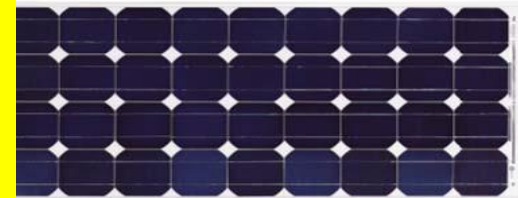


The sunlight is very diffused $\sim 100 \text{mW/cm}^2$

Progress in solar cells

❑ 1st generation

- Crystalline silicon on glass
- Developed in the 70s
- Efficient, expensive, heavy, no flexibility



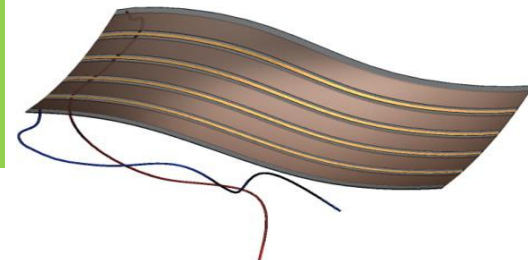
❑ 2nd generation

- **Thin film (majority on glass)**
- Developed in the 80s
- Efficient, expensive, less heavy, small flexibility



❑ 3rd generation

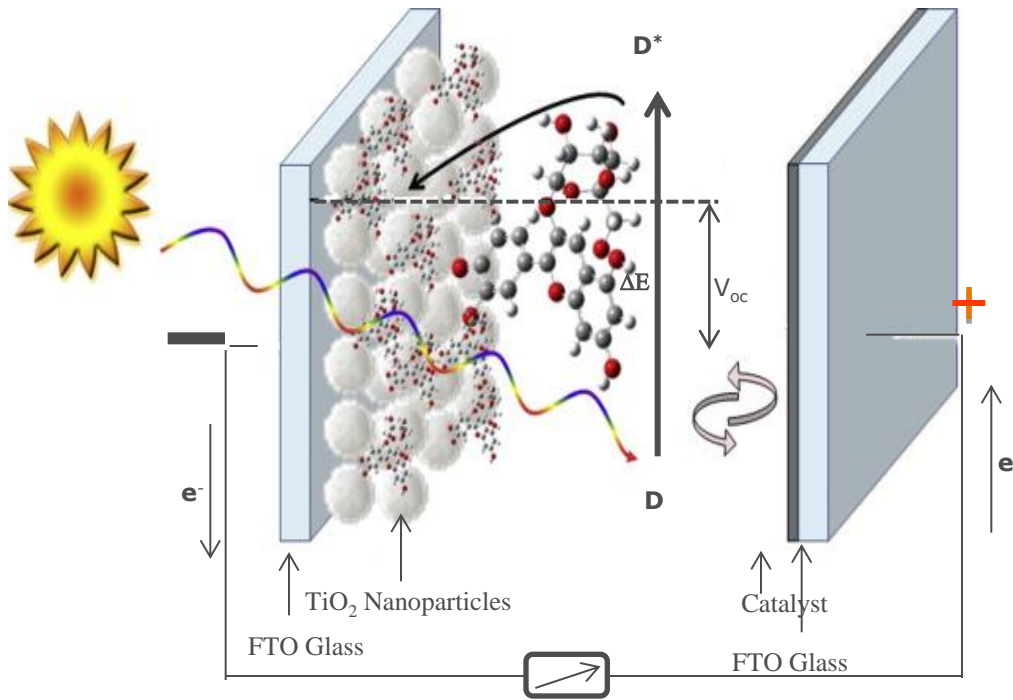
- **Dyes, Polymers & nanomaterials**
- Developed in the 90s
- Less efficient, cheap, very light weight, flexible



Why DSCs?



Gratzel DSCs.

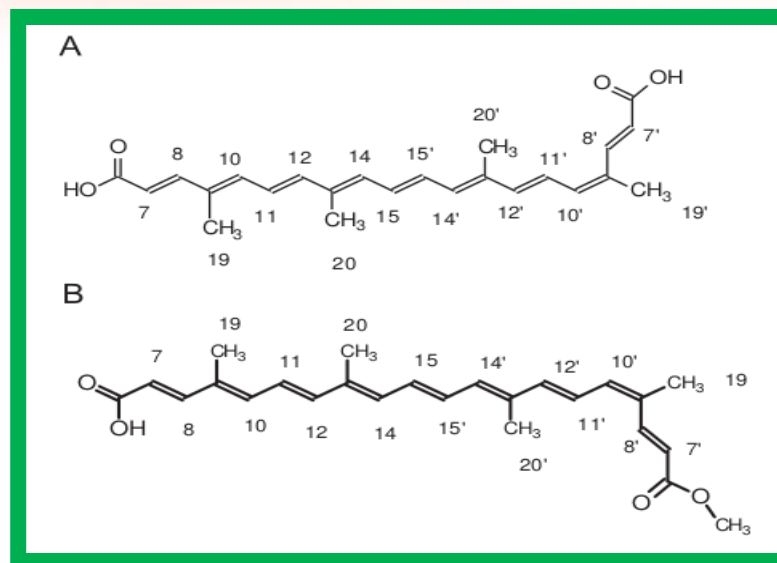


Structure of Gratzel DSC

Basic principle of operation

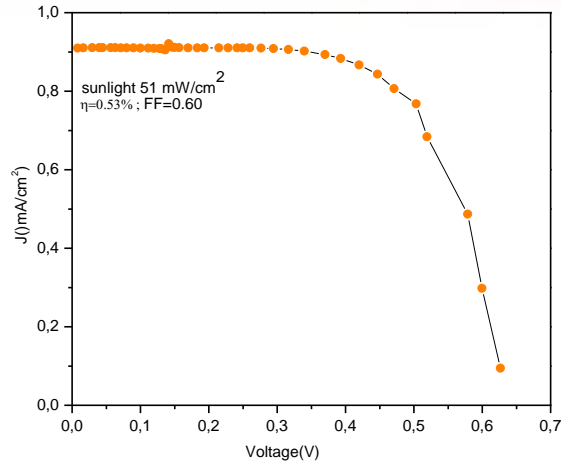
- $D + h\nu \rightarrow D^*$: photoexcitation
- $D^* \rightarrow D^+ + e^-_{TiO_2}$: electron injection
- $D^+ + e^-_{TiO_2} \rightarrow D$: back transfer of electrons to D^+
- $2D^+ \rightarrow D^+ + 3I^-$: regeneration of dye by iodine
- $I^-_3 + e^-_{TiO_2} \rightarrow D + I^-_3$: back transfer of electrons to I^-_3

Bixa orellana dye



- Originally from Latin America
- Molecular structure exhibits linear conjugated system.

Bixa orellana as sensitizer.



N.M. Gómez-Ortiz et al.

□ η = 0.53%

□ FF = 0,60%

$$\eta(\%) = \frac{J_{sc} V_{oc} FF P_{max} V_{max}}{P_{in} P_{in}}$$

$$FF = \frac{J_{max} V_{max}}{J_{sc} V_{oc}}$$

- J_{sc} : the short-circuit photocurrent density for monochromatic irradiation
- V_{oc} : Open circuit voltage (V)
- FF (fill factor): Quantitative measure of the device quality
- P_{in} : Intensity of incident light (W)

Conclusion

- ❑ The renewable energies are expected to play an active role in the future energy.
- ❑ Natural dyes are extensively investigated as sensitizers.
- Bixa orellana is promising for dye solar cells. However, the efficiency of the energy conversion is low. Therefore our main goal is to improve this efficacy.
- ❑ Alternative to further reduction of the production costs of these revolutionary DSC devices.



Clean & Environmentally friendly

Thank you!!!