GREEN CHEMISTRY

for

Resource Optimization

in

Chemical Industries.

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❖ WASTE MANAGEMENT SUMMIT 2014

THEME : **RESOURCES MANAGEMENT**

for

SUSTAINABLE FUTURE

Preamble

❖ **GREEN CHEMISTRY** principles rest upon

1. Atom Economy (Highest Selectivity)

Raw materials, Chemicals & catalyst consumption must be as low as theoretical possible. Direct impact on OPEX.

2. SHE compliance

Processes must be inherently Safe, no occupational Health hazard & ***Environmentally benign.***

3. ENCON Global warming (Carbon footprint), ODP

ATOM ECONOMY MEANS:

- LESS CONSUMPTION OF RAW MATERIALS
- LOWER COST OF PRODUCTION
- LESS EFFLUENTS
- ETP LESS COSTLY (CAPEX & OPEX)

1. ATOM ECONOMY

OXO PROCESS :

$C_3^{=}$ + (CO + H_2) = n C_4 al (n- butyraldehyde)

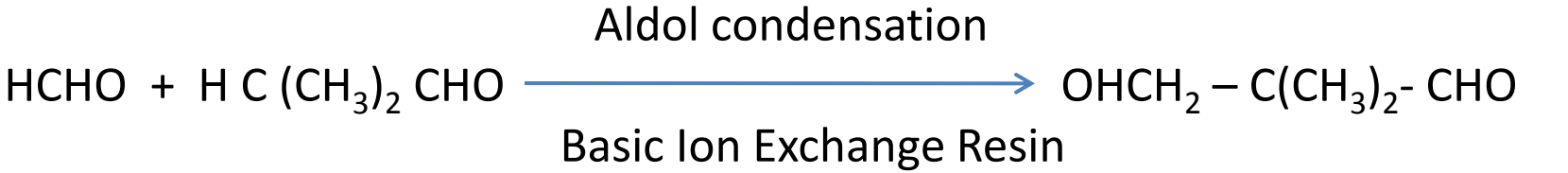
+ iso C_4 al (iso- butyraldehyde)

OLD Process : Catalyst Co ~ 25% iso C_4 al , 250 bar, 150°C

LP OXO (JM Davy) : Catalyst Rh ~ 10% iso C_4 al, 16 bar, 120°C

R / RP Biphasic water soluble Rh ~ <2% iso C_4 al, 100 bar, 120 °C

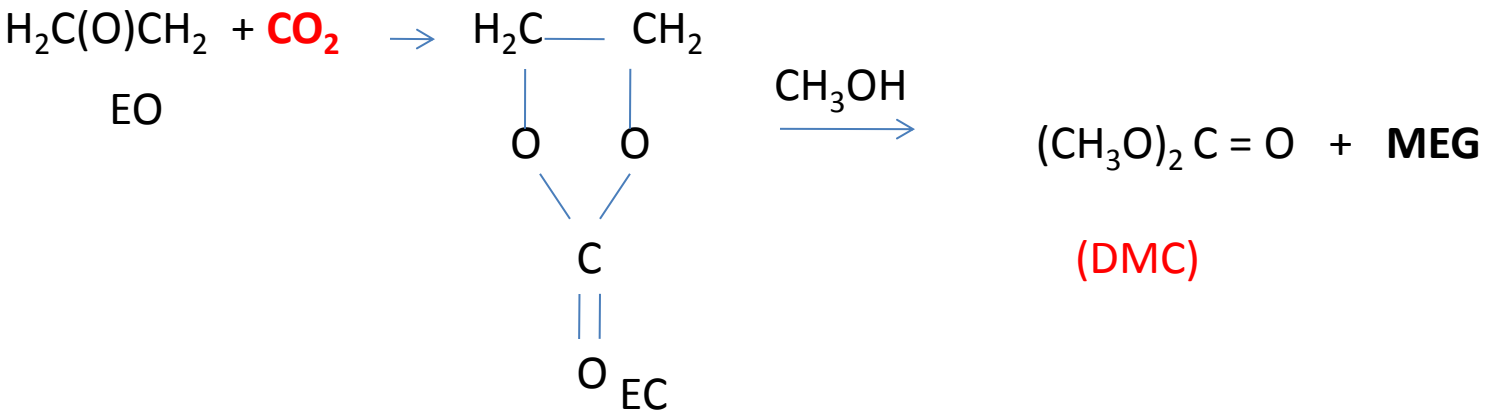
UTILIZATION OF iso C_4 al (iso- butyraldehyde)



Hydroxy pivaldehyde *Neopentyl glycol*

Studies to aid process development for the manufacture of neopentyl glycol from isobutyraldehyde: aldol condensation followed by hydrogenation. M. A. Tike, A. M. Gharde, and ***V. V. MAHAJANI,*** *Asia-Pac. J. Chem. Eng;* ***3****: 333 (2008).*

MANUFACTURE OF ETHYLENE CARBONATE (EC) & THEN DMC



*Studies in transesterification of ethylene carbonate to dimethyl carbonate over Amberlyst A-21 catalyst. S.M.Dhuri and **V.V.MAHAJANI**, J.ChemTech Biotech. **81** 62 (2006).*

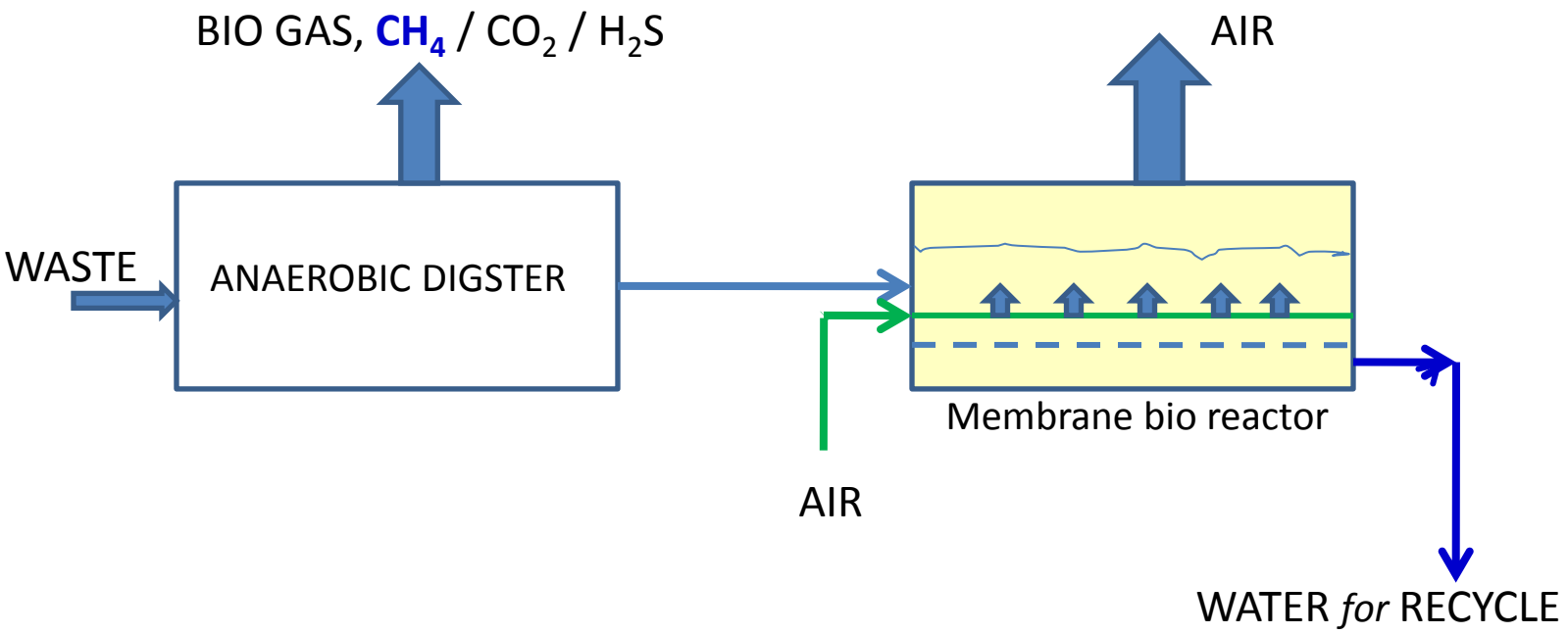
Oxidation Reactions results in acids formation:

- Acetic acid
- BVC Acids
- Maleic , phthalic acids, citroconic acid
- Aromatic acids: Benzoic, isophthalic, phthalic acid.

2. ENVIRONMENT MANAGEMENT

All liquid effluents, if required, should be treated with Fenton Reagent to enhance:

Biodegradability Index : BOD / COD



BIOMASS GASIFICATION to PRODUCE

❖SYN-GAS (CO,CO_2 & H_2)

SYN –GAS:

- POWER
- FERTILIZERs
- METHANOL : GASOLINE & DIESEL, Bio Diesel CHEMICALS

3.CARBON FOOT PRINT:

GREENHOUSE GAS (CO_2)

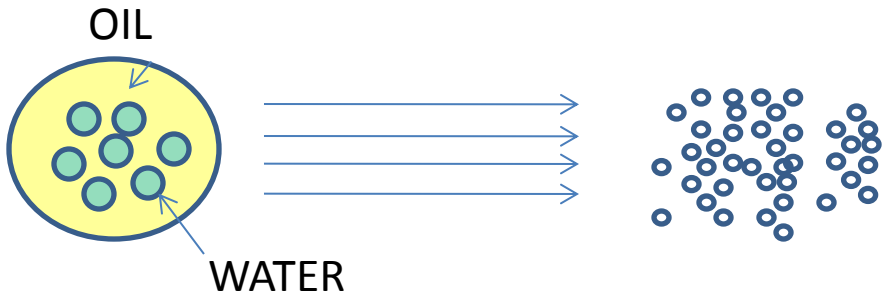
1. ALL ACTIVITIES INVOLVING COMBUSTION TO GENERATE STEAM FOR HEATING PURPOSE AND ALSO VERY HIGH PRESSURE STEAM FOR POWER GENERATION ARE REQUIRED TO BE VERY EFFICIENT TO PRODUCE LESS CO_2.

HOW to do this in the case of FO?

USE W/ O EMULSION :

WATER SAY, 5%, EMULSIFIED WITH FURNACE OIL

IS USED AS FUEL IN A BOILER



FINE SUB MICRON FUEL PARTICLES BURN EFFICIENTLY:

LOW NOx,
NO SOOT, MORE HEAT is RELEASED Less emission of CO_2 / T steam

➢ MANUFACTURE *of* BIODIESEL

Non Edible oils: Karanj, Jatropha etc

- PLANT NON EDIBLE OIL TREES AROUND AND USE OIL AS FUEL IN A BOILER.

- VIA CSR GIVE VILLAGERS EARNING

  VILLAGERS CAN EXPEL OIL AND SELL THIS TO POWER STATION or to Bio-Diesel manufacturer

- THE CAKE CAN BE USED AS BIO FERTILIZER.

Price = β (Project Cost) + Gross Cost of Production

- ✓ *β = includes profit,*
  (Bottom Line)

INNOVATION IS ANYTHING THAT PRODUCES MONEY