USE OF BIOPLASTICS, BIODEGRADABLE INKS & ENVIRONMENTAL FRIENDLY CHEMICALS AS PACKAGE SUBSTRATE AND PRINT ESSENTIALS

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:: Outline of Presentation ::

- **Introduction to Packaging**
- **Strategies towards Green Packaging**
- **Strategies towards Green Printing**
- **Conclusion**

INTRODUCTION

- The printing was started with the use of leaf (Bhojpatra) as substrate and invention of paper gave it appropriate speed which is biodegradable in real sense.
- Flexo and gravure printing adopted the poly based printing substrates widely for printing and packaging.
- The other essentials were developed / modified without any consideration of its environmental impact and hazards.
- As the world is becoming cognizant about the hazardous effect of plastic and other chemicals used in printing on the environment.
- To support this, researchers have come up with natural option of Bioplastics, Biodegradable inks and Green Consumables for Printing and Packaging.

STRATEGIES TOWARDS GREEN PAKAGING

INTRODUCTION

A packaging serves to fulfill the following:

STRATEGIES TOWARDS GREEN PAKAGING

INTRODUCTION

Materials Used for Packaging

- Paper & Paper Board
- Plastics
- Metals
- Glass
- Others

This section is the biggest threat to the environment and need to be replaced for GREEN PACKAGING

Source: Rexam, Consumer Packaging Report 2007-2008

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USE OF BIOPLASTICS AS PACKAGING SUBSTRATE

Introduction

- Bio-Plastics are **not a single class of polymers but** rather a family of products which can vary considerably.
- Bio-Plastics consist of
  - **Bio based plastics, based on renewable resources**
  - **Biodegradable polymers, which meet all criteria of** scientifically recognized norms for biodegradability and compostability.
- Bioplastics are a form of plastic derived from renewable biomass source, such as vegetable oil, corn-starch, potato-starch or microbia, rather than fossil-fuel plastics which are derived from petroleum.

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COMPOSITION:

Bioplastics can be made from many different sources and materials:

- **Plant Oil**
- **Cellulose**
- **Corn Starch**
- **Potato Starch**
- **Sugarcane**
- **Hemp etc.**

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USE OF BIOPLASTICS

Classification of Bioplastics:

- **Starch based plastics**
- **Bioplastics produced from classical chemical synthesis from bio based monomers**
- **Polylactic Acid (PLA) plastics**
- **Bioplastics produced directly by natural or genetically modified organisms**
- **Polyamides 11**
- **Polycaprolactones**

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USE OF BIOLASTICS

Conventional Plastics used in Packaging:

The main fossil fuel based plastics used in the packaging are:

- LDPE
- LLDPE
- HDPE
- PP
- PVC
- Nylon
- Polyester etc.

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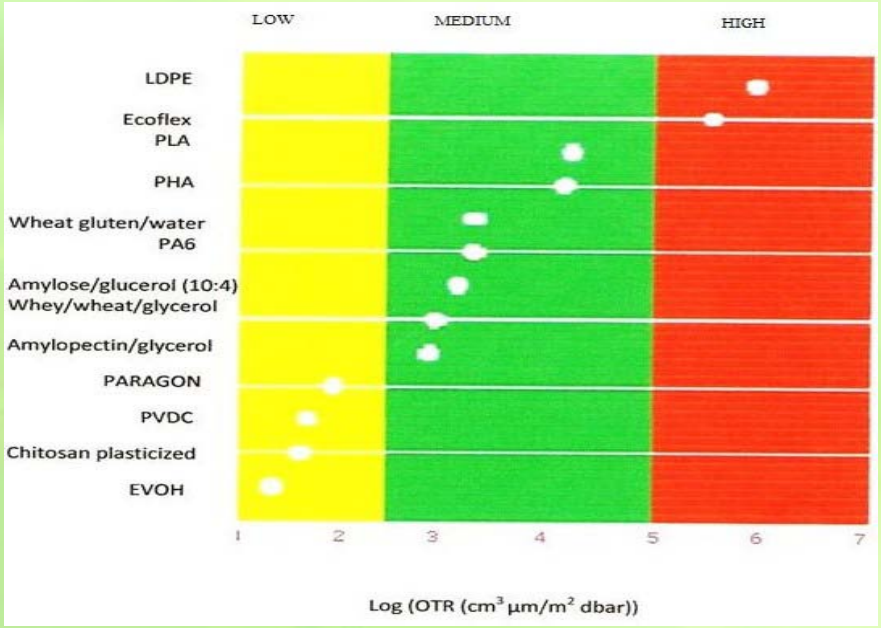
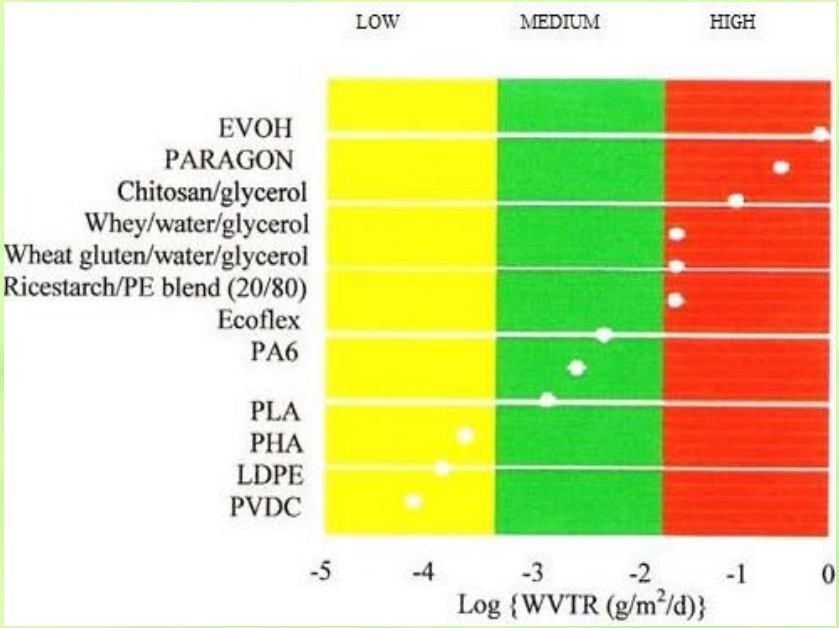
PROPERTIES OF BIOPLASTICS AND ITS COMPARISON WITH CONVENTIONAL PLASTICS FOR ITS APPLICATION IN PRINTING & PACKAGING:-

Due to biological biodegradability the use of bioplastics is especially popularizing in the packaging sector

- ***Gas barrier properties:*** Bio based materials have quite same oxygen permeability that of conventional mineral-oil-based materials and it is possible to select from a range of barriers among the present bio based materials.





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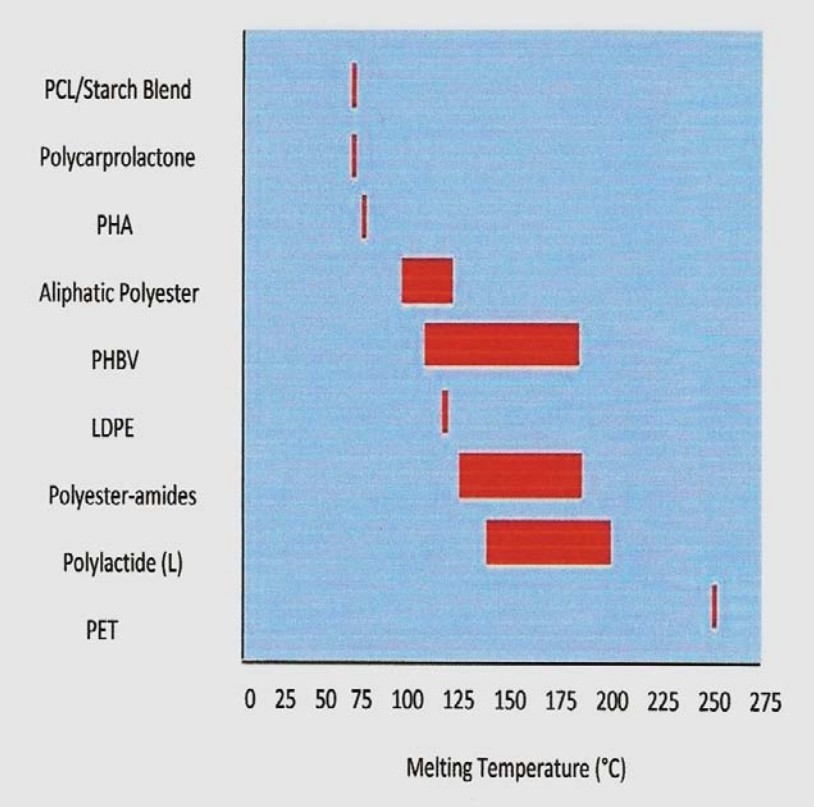
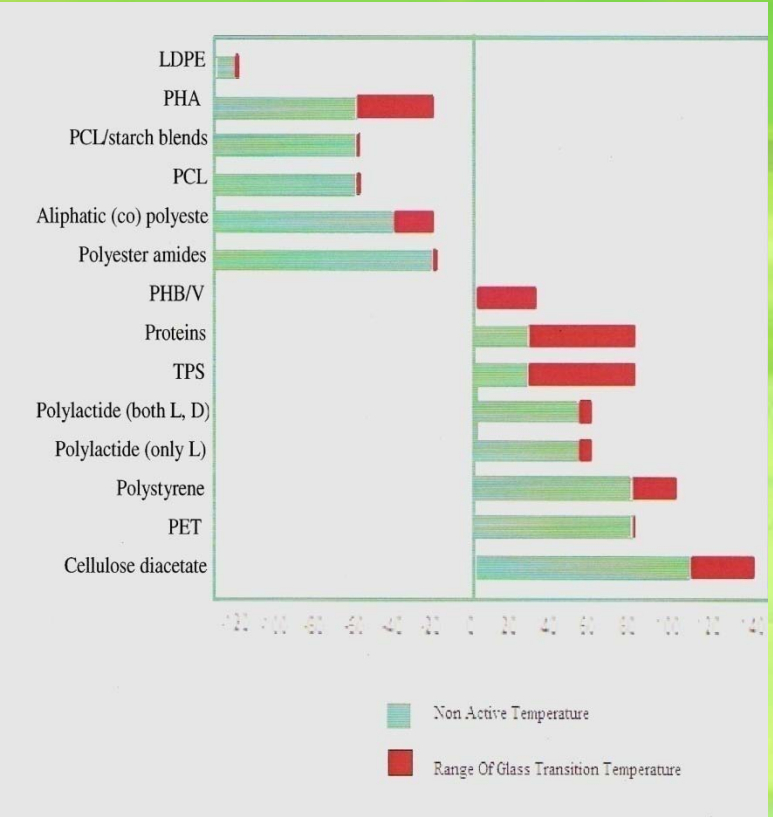
- ***Water vapour transmittance:*** While comparing the water vapour transmittance of various bio based materials to conventional plastics it comes out that it is possible to produce bio based materials with water vapour transmittance rates comparable with some conventional plastics.

- ***Thermal and mechanical properties:*** The thermal and mechanical properties of the materials are important for processing and for use of the products derived from these materials. Most bio based polymer materials act in a similar fashion to conventional polymers. This indicates that polystyrene, polyethylene and PET-like materials can be found among the available bio based polymers. The mechanical properties in terms of modulus and stiffness are not much different compared to conventional polymers.

Contd….


PCL/Starch Blend
Polycarprolactone
PHA
Aliphatic Polyester
PHBV
LDPE
Polyester-amides
Polylactide (L)
PET
0 25 50 75 100 125 150 175 200 225 250 275
Melting Temperature (°C)


LDPE
PHA
PCL/starch blends
PCL
Aliphatic (co) polyeste
Polyester amides
PHB/V
Proteins
TPS
Polylactide (both L, D)
Polylactide (only L)
Polystyrene
PET
Cellulose diacetate
Non Active Temperature
Range Of Glass Transition Temperature

PROPERTIES OF BIOPLASTICS (ASTM Standards)

Physical properties	
Mold shrinkage	0.0125-0.0155 in/in
Density	1.4g/cm³
Apparent viscosity(180ºC, 100 sec^{-1})	950 P
Thermal properties	
Melting point	160-165ºC
Heat distortion temperature	143ºC 78ºC
Vicat softening temperature	147ºC
Mechanical properties	
Tensile strength	26 MPa(3800psi)
Shrinkage	0.93% caliper
Tensile modulus	3400 MPa(494,000psi)
Tensile elongation brake	3%
Compressive yield Stength	65MPa (approx)
Compressive Modulus	2GPa (approx)
Flexural strength	44 MPa(6390psi)
Izod impact strength	26 J/m(0.5 ft lbs/in)
Hardness	54 shore D(90ºC,2.16kg)
Bending module	387 MPa
Moisture absorption	0.16% (23ºC, 50% RH)
Transparency	High
Oxygen barrier	Medium-high
Other Properties	
Stackability	Fair
Puncture Resistance	Excellent
Crystallinity	60

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STRATEGIES TOWARDS GREEN PAKAGING

ADVANTAGES OF BIOPLASTICS

The need of replacement for the petroleum based plastic with bioplastics is just because

- Producing conventional plastics consumes 65% more energy than producing bioplastics.
- Conventional plastic are mostly toxic.
- Plastics last a long time and do huge damage to environment. Therefore, plastic is absolutely unsustainable and bioplastics is more sustainable.
- Bioplastics saves 30-80% of the greenhouse gas emissions and provide longer shelf-life than normal plastic.
- Safe Biodegradability

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ADVANTAGES OF BIOPLASTICS

- Compost derived in part from bioplastics increases the soil organic content as well as water and nutrient retention, with reducing chemical inputs and suppressing plant diseases.
- Starch-based bioplastics have been shown to degrade 10 to 20 times quicker than conventional plastics.
- On burning traditional plastics, create toxic fumes which can be harmful to people's health and the environment. If any biodegradable films are burned, there is little, if any, toxic chemicals or fumes released into the air.
- Compared to conventional plastics derived from petroleum, bio-based polymers have more diverse stereochemistry and architecture of side chains which enables research scientists a great number of opportunities to customize the properties of the final packaging material.

STRATEGIES TOWARDS GREEN PRINTING

- INTRODUCTION
- GREEN CONSUMABLES
- USE OF BIODEGRADABLE INKS
- VOC’s REDUCING STRATEGIES

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STRATEGIES TOWARDS GREEN PRINTING

INTRODUCTION

Ecological Printing has become increasingly important to all who are concerned about well- being of our planet.

It was Mahatma Gandhi who said :

" *The Future depends on what we do in the present* "

We need to do something now to radically change the way we conserve the environment in which we live, for future generations.

White paper as a printing substrate is bleached via Chlorination process that releases dangerous chemicals and pollutants into water.

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STRATEGIES TOWARDS GREEN PRINTING

INTRODUCTION

Adhesives, bindings used in printing and packaging can render the final product unrecyclable.

Petroleum based inks can cause lasting damage to the environment.

Leaching VOC's can cause cancer and birth defects.

Solvents, shellacs, driers and other solutions employed in producing film, printing plates, and cleaning the presses are toxic pollutants that can cause chronic health problems.

STRATEGIES TOWARDS GREEN PRINTING

GREEN CONSUMABLES

- Substrate is one of the main consumable in Printing and paper the mostly used substrate. To make our print green we can use alternative papers like Stone paper, ECF- elemental chlorine free paper, New leaf paper etc.

- Chem-free violet CtP, Chem-free Thermal CtP, Process-free Inkjet Metal CtP, Process-free Inkjet Polyester CtP solutions and FOGRA approved Alcohol-free & Alcohol reducing founts, Aromatic-free press washes, Low hazard cleaners & deglazers launched by the "Technova" and similar products by other manufacturers are the really appreciable efforts for achieving "green" printing and packaging

STRATEGIES TOWARDS GREEN PRINTING

USE OF BIODEGRADABLE INKS

- The ink industry has reformulated all inks to exclude the known toxic metals like lead, cadmium, mercury and hexavalent chromium. While there is some evidence that vegetable oils themselves are more biodegradable than petroleum oils.

- There are a wide range of current renewable raw material components that are used in various printing inks formulations which includes:
  - vegetable oils and esters,
  - alkyd/rosin esters,
  - cellulose esters/nitrocellulose,
  - fatty acid amides, epoxy soy bean oil,
  - vegetable waxes, and bio-ethanol.

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STRATEGIES TOWARDS GREEN PRINTING

USE OF BIODEGRADABLE INKS

ADVANTAGES

- Biodegradable inks are low in VOC's.
- This smart substitute is sustainable, efficient and cost- competitive.
- It is 100% biodegradable
- Available in bright colors
- Makes it easier to recycle paper.

STRATEGIES TOWARDS GREEN PRINTING

VOC's REDUCING STRATEGIES

There are several ways that VOC emissions from the printing industry can be reduced.

- Adopt techniques to treat the VOC stream. These may include different type of incineration processes like Thermal incineration, Catalytic incineration and Regeneration incineration.

- Material Substitution- by using inks, cleaners and fountain solutions that are low in VOC's.

- Switch to Vegetable Oil Based Inks and Water based Inks instead of Petroleum based Inks.

GREEN PRINT PACKAGING

CONCLUSION

Biodegradable plastics are one of the most innovative materials being developed in the printing & packaging industry. How widespread bioplastics will be used all depends on how strong society embraces and believes in environmental preservation. It is important to recognize that although past and recent efforts have thus for yielded significant strides in the field of bioplastics. To establish themselves, these materials have to be well performing in order to be able to compete with highly developed and sophisticated materials/substrates used today in printing & packaging.

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Thank you