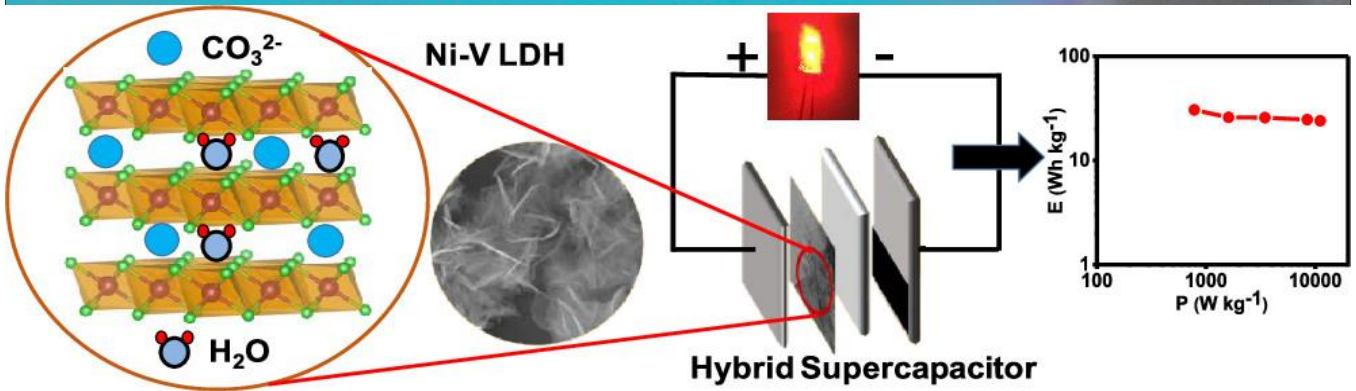
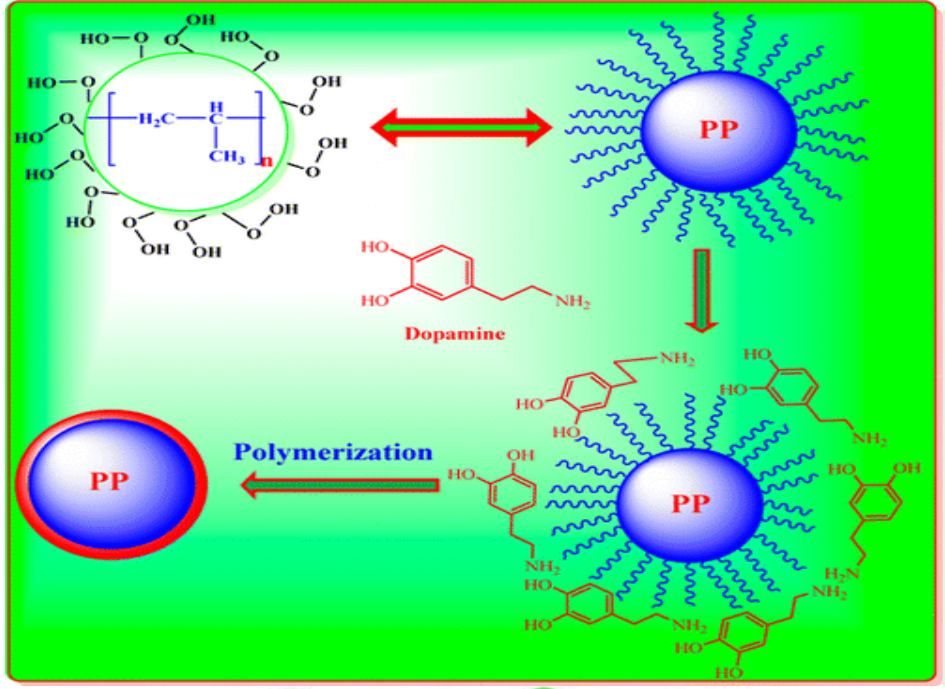
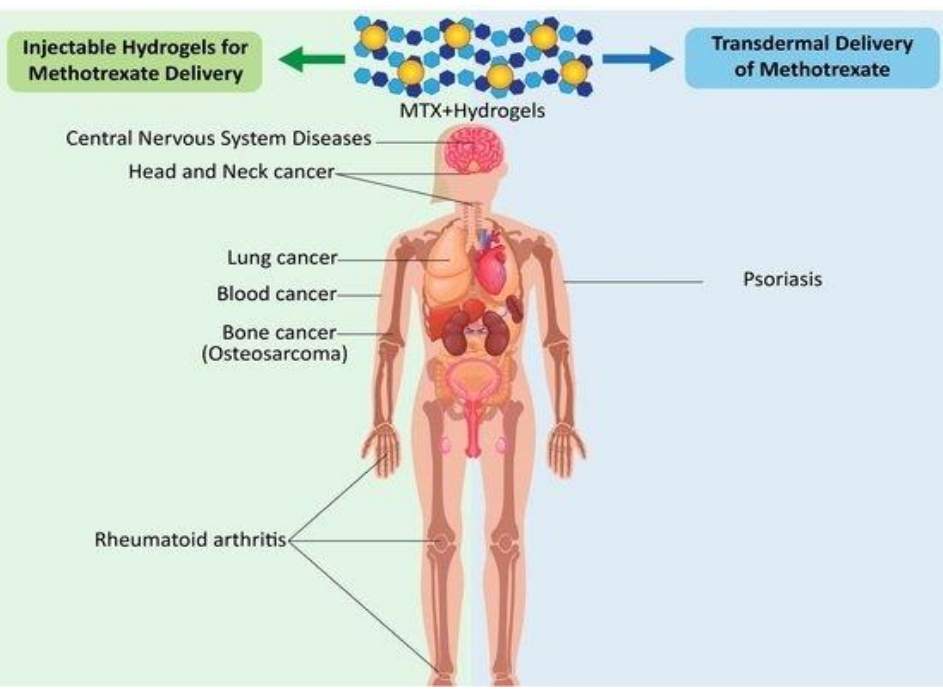
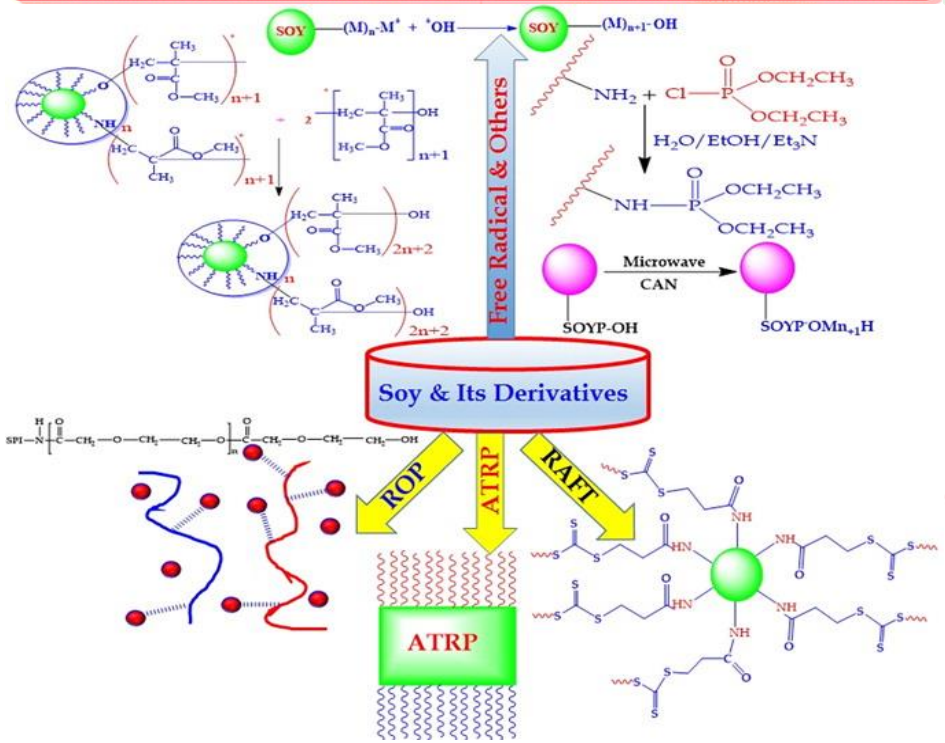
Developing advanced nanocomposites from biorenewable resources

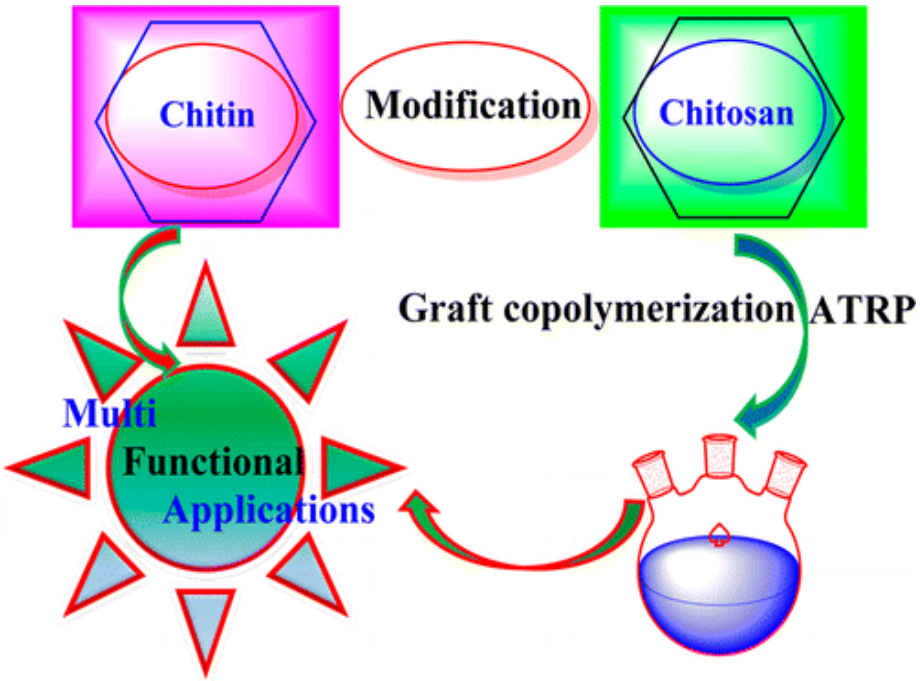
Bioinspired Surface Engineering for Energy Storage, Harvesting, Biomedical and Beyond



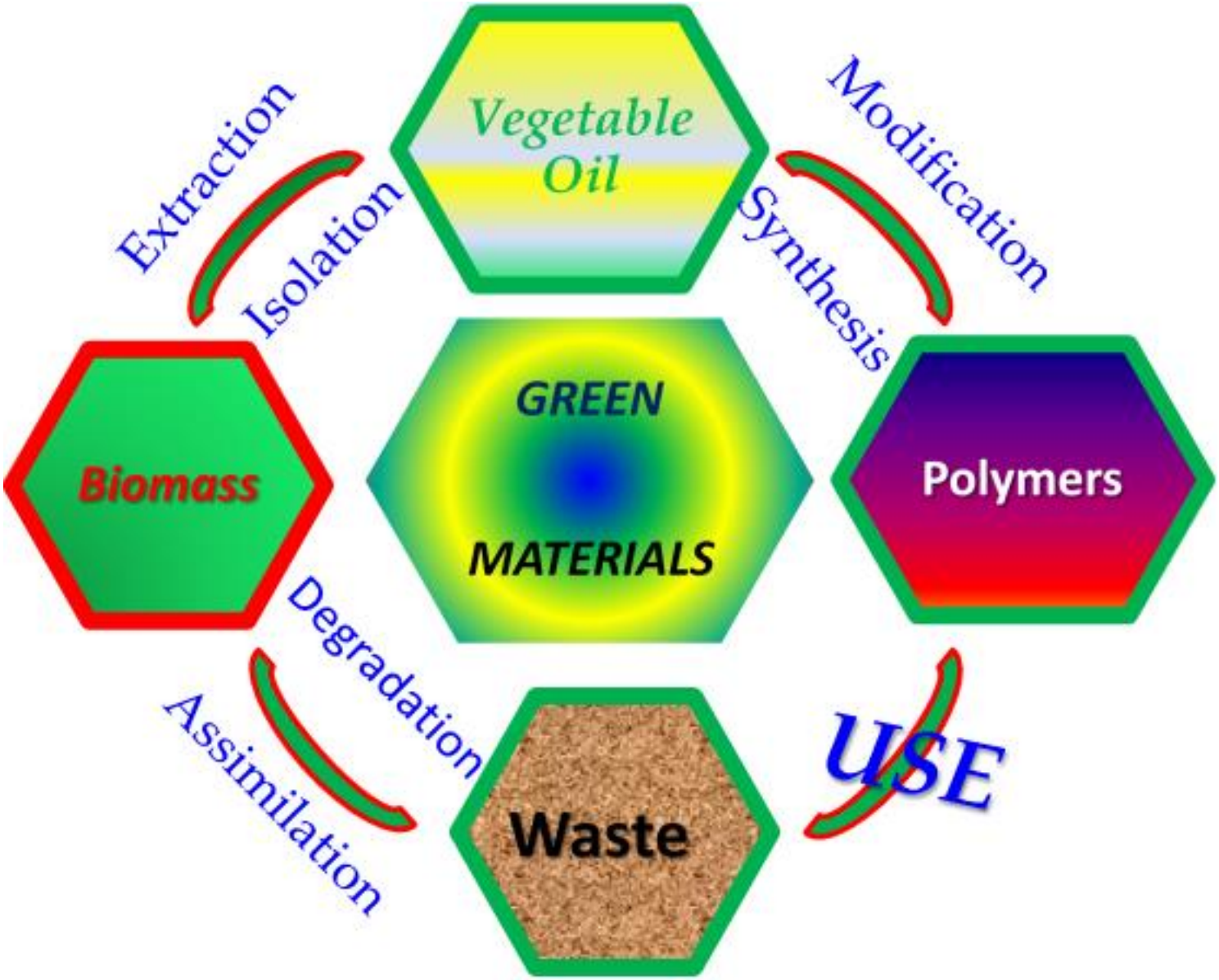

PP
Dopamine
Polymerization
PP
PP

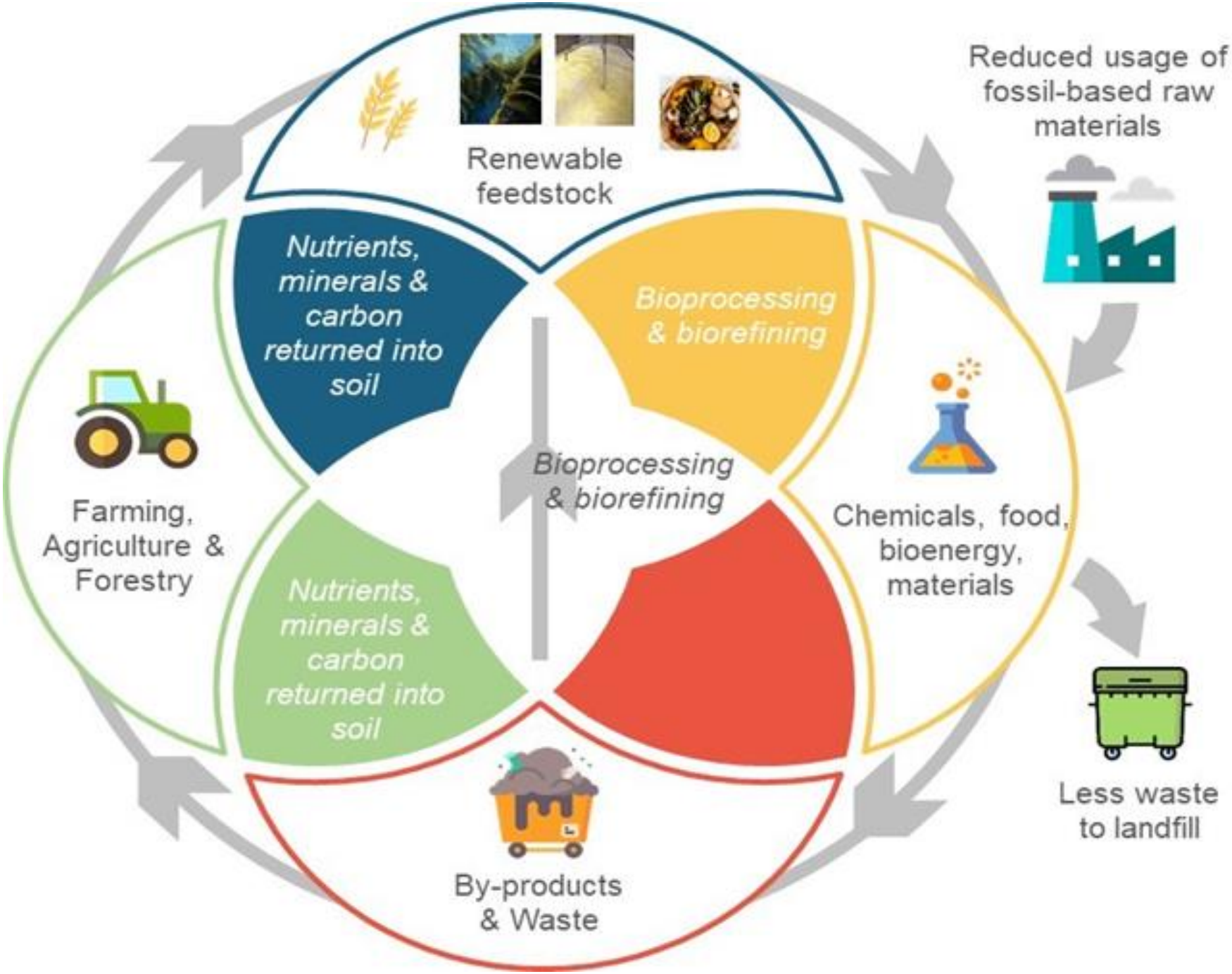

Injectable Hydrogels for Methotrexate Delivery
Transdermal Delivery of Methotrexate
MTX+Hydrogels
Central Nervous System Diseases
Head and Neck cancer
Lung cancer
Blood cancer
Bone cancer (Osteosarcoma)
Psoriasis
Rheumatoid arthritis

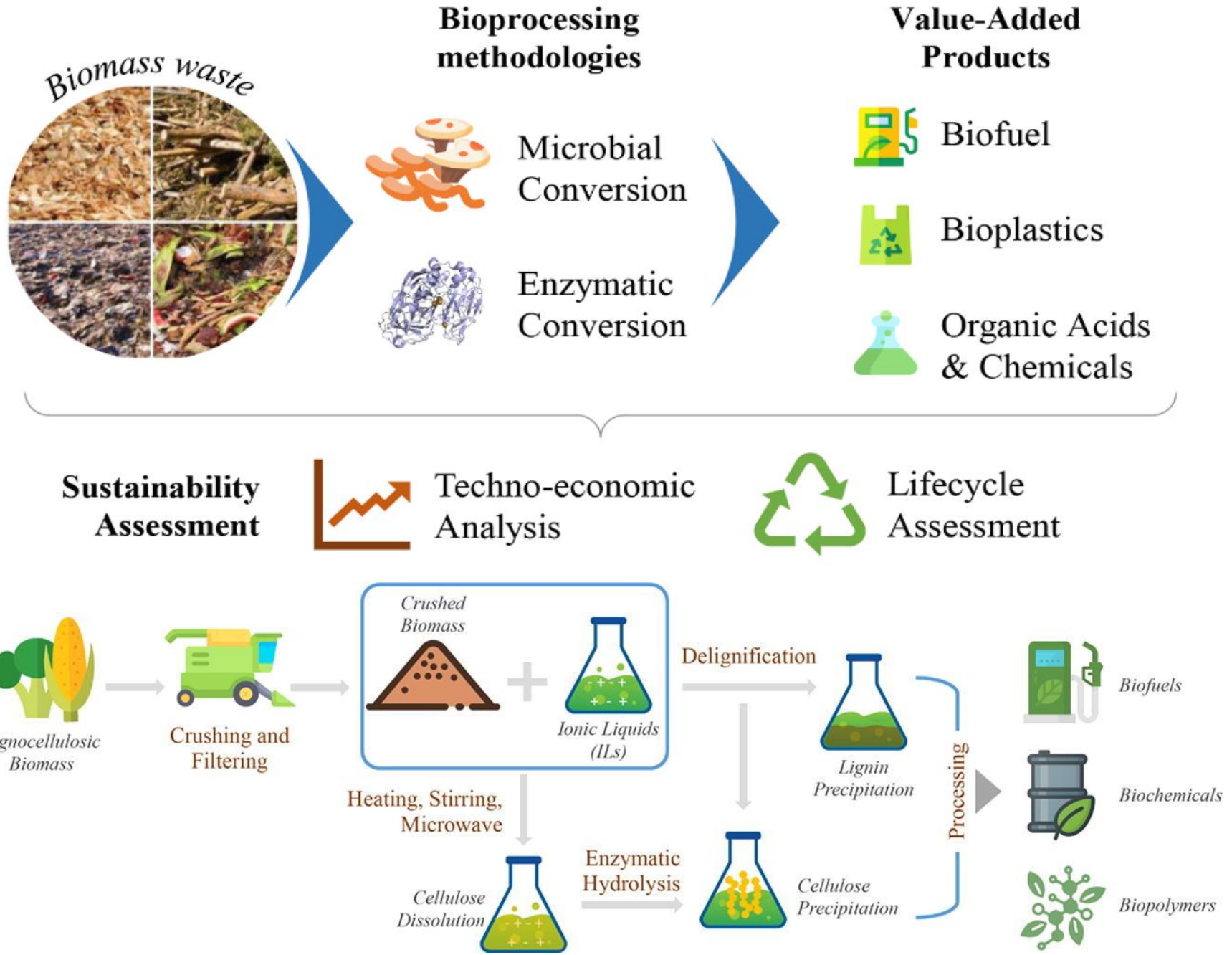

SOY
Free Radical & Others
Microwave
CAN
SOYP-OH
H2O/EtOH/Et3N
Soy & Its Derivatives
ROP
ATRP
RAFT
ATRP

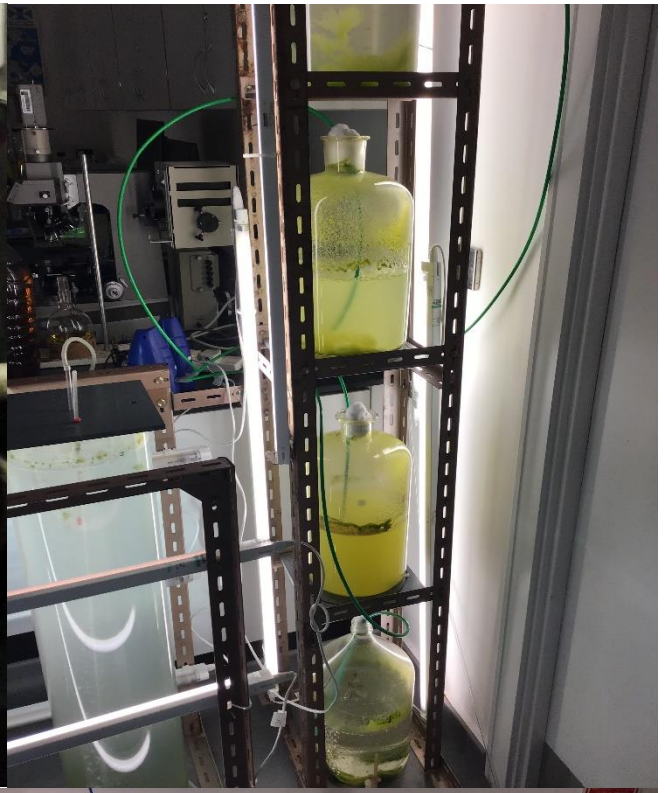
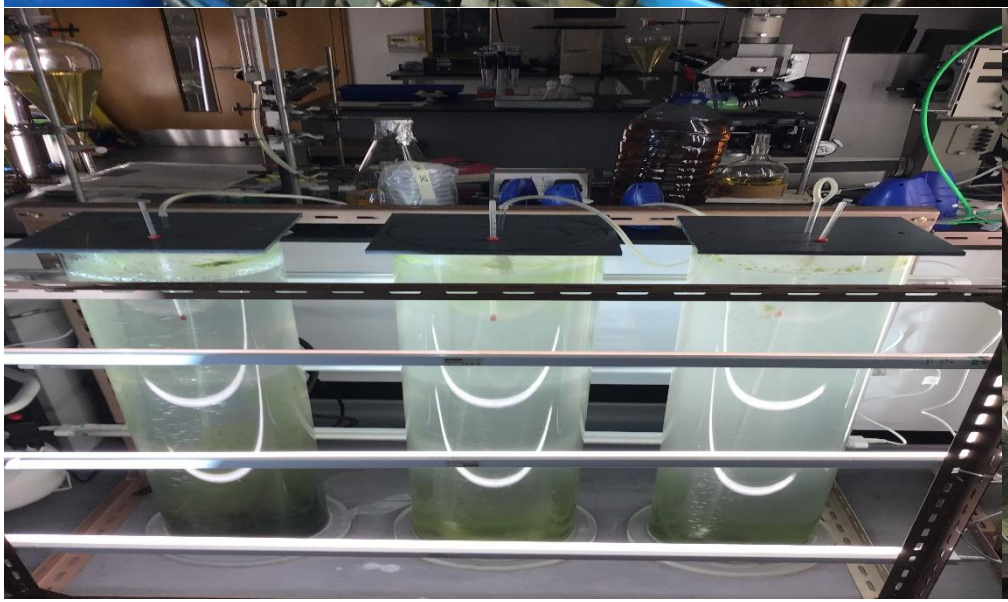
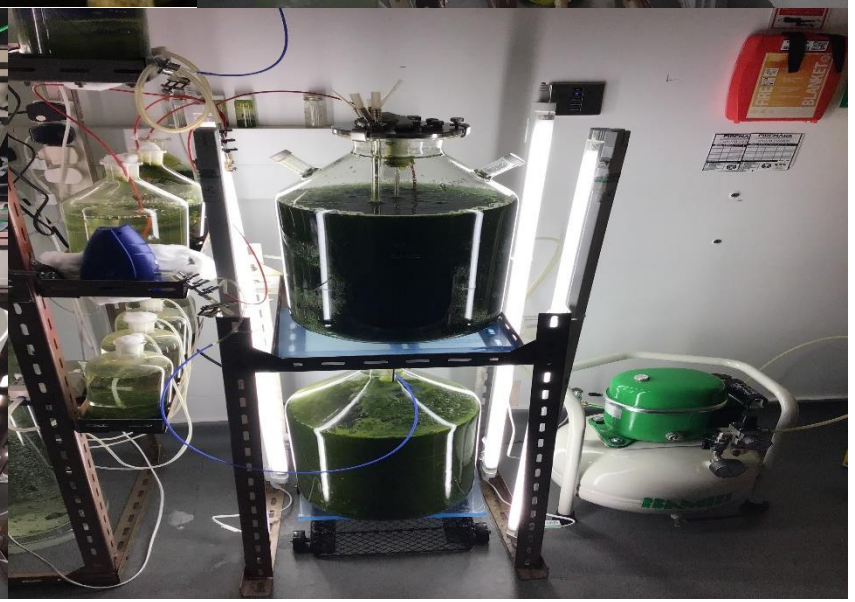

Chitin
Modification
Chitosan
Graft copolymerization ATRP
Multi
Functional
Applications

Transforming Dairy and Agricultural Waste into High-Value Materials

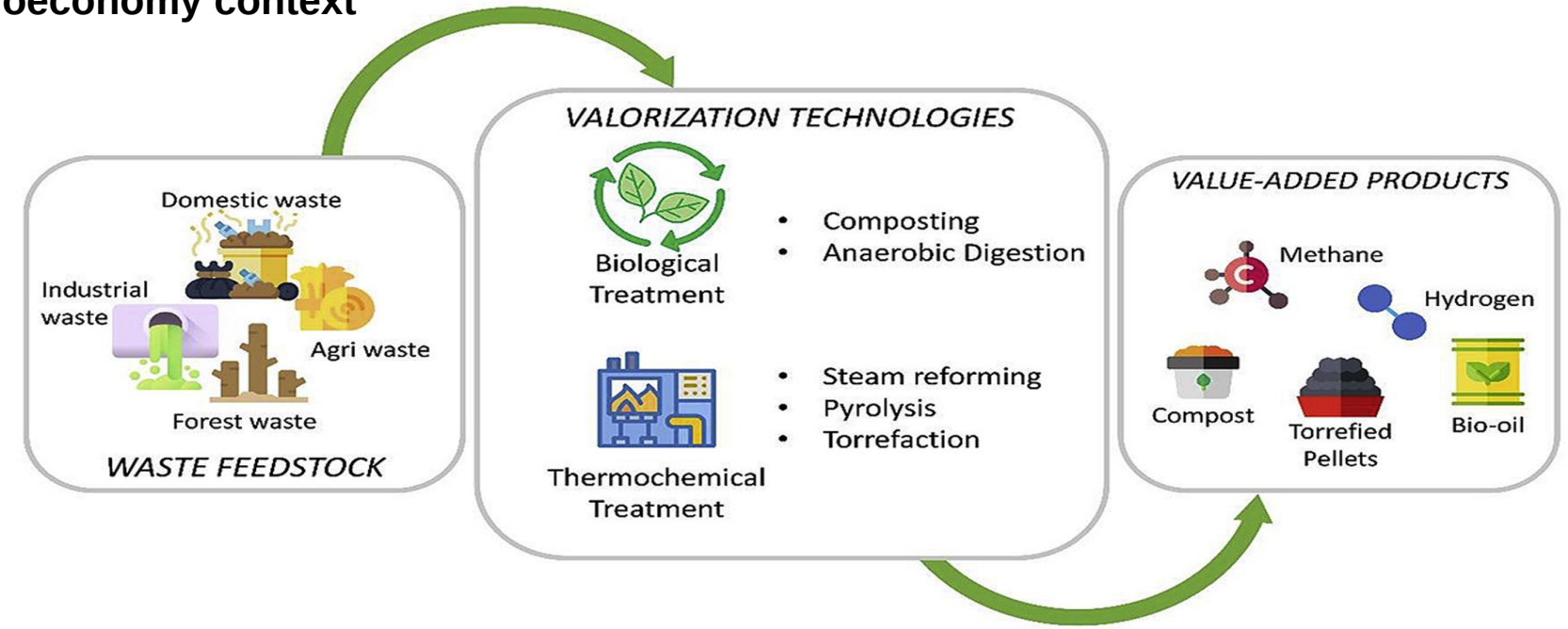


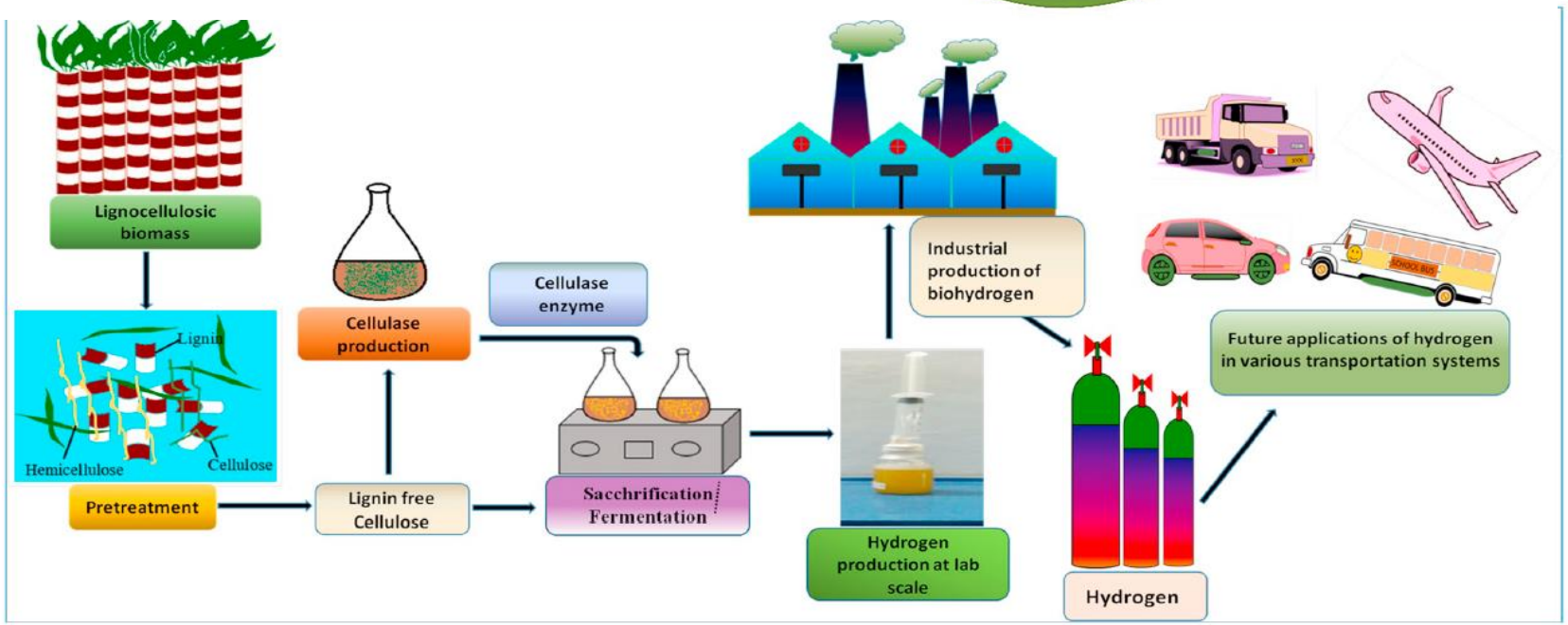

Renewable feedstock
Reduced usage of fossil-based raw materials
Bioprocessing & biorefining
Nutrients, minerals & carbon returned into soil
Bioprocessing & biorefining
Chemicals, food, bioenergy, materials
Farming, Agriculture & Forestry
Nutrients, minerals & carbon returned into soil
Less waste to landfill
By-products & Waste


Biomass waste
Bioprocessing methodologies
Microbial Conversion
Enzymatic Conversion
Value-Added Products
Biofuel
Bioplastics
Organic Acids & Chemicals
Sustainability Assessment
Techno-economic Analysis
Lifecycle Assessment
Lignocellulosic Biomass
Crushing and Filtering
Crushed Biomass
Ionic Liquids (ILs)
Heating, Stirring, Microwave
Cellulose Dissolution
Delignification
Lignin Precipitation
Enzymatic Hydrolysis
Cellulose Precipitation
Processing
Biofuels
Biochemicals
Biopolymers

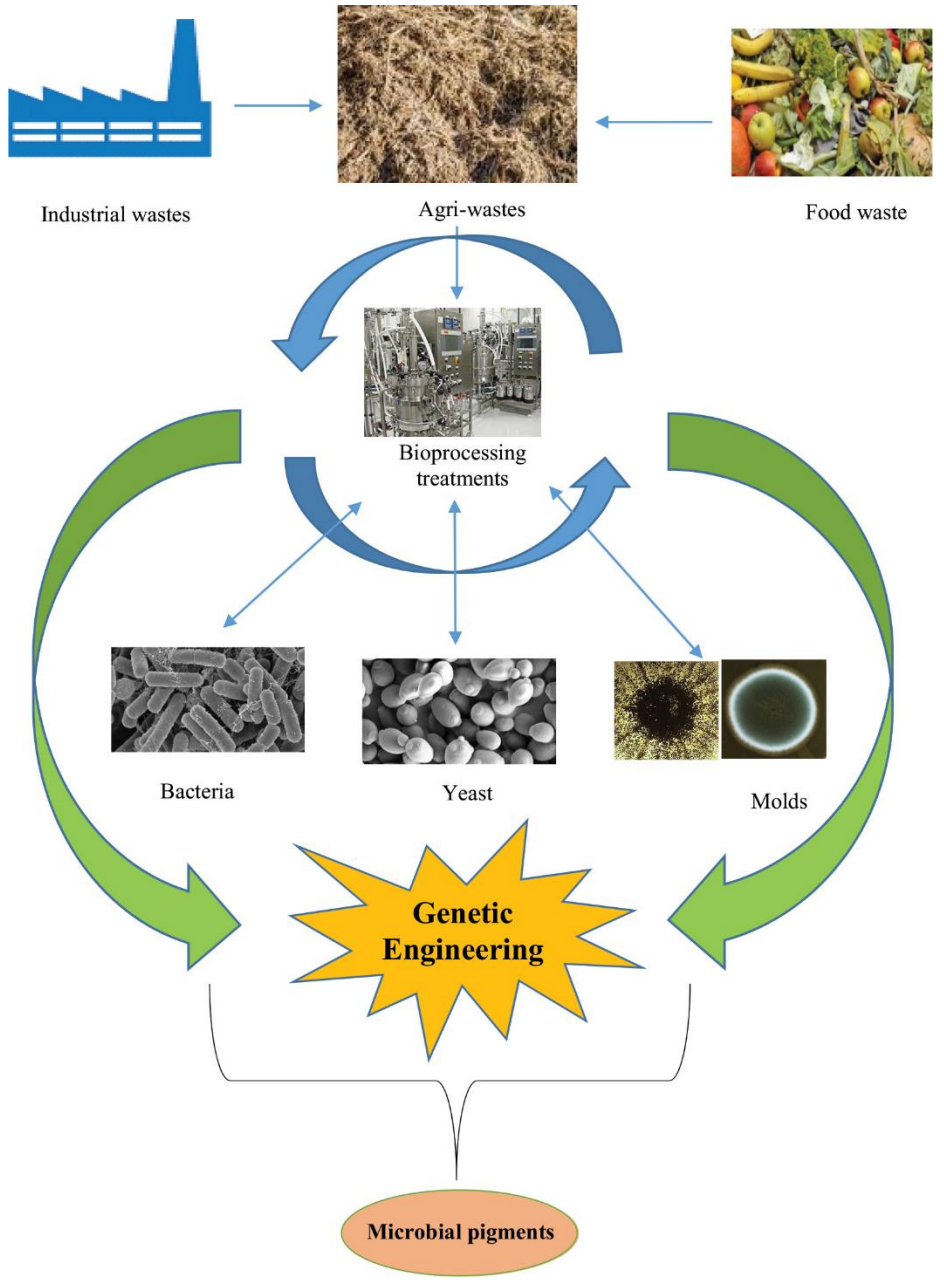





Advancement in valorization technologies to improve utilization of bio-based waste in bioeconomy context

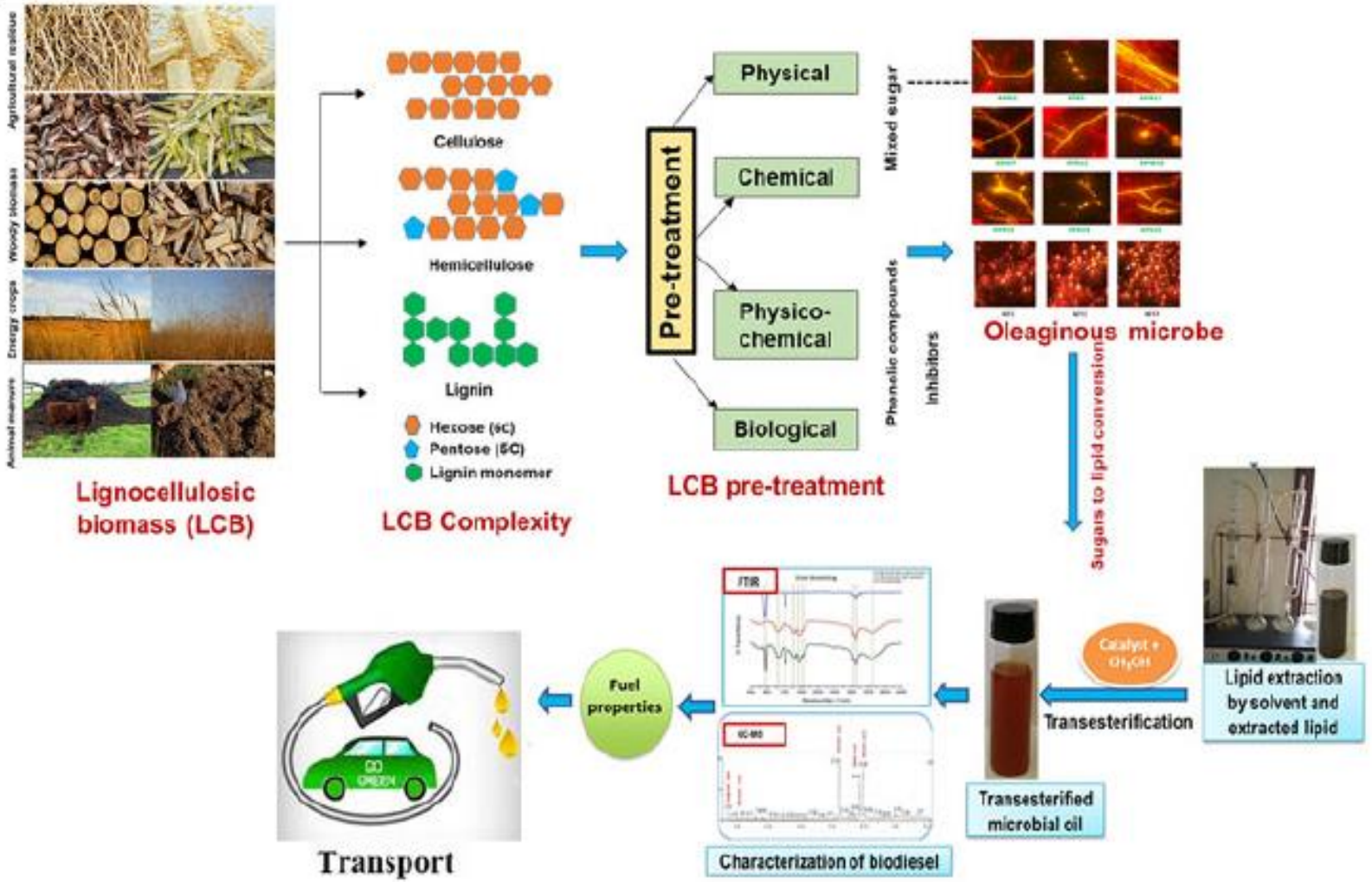




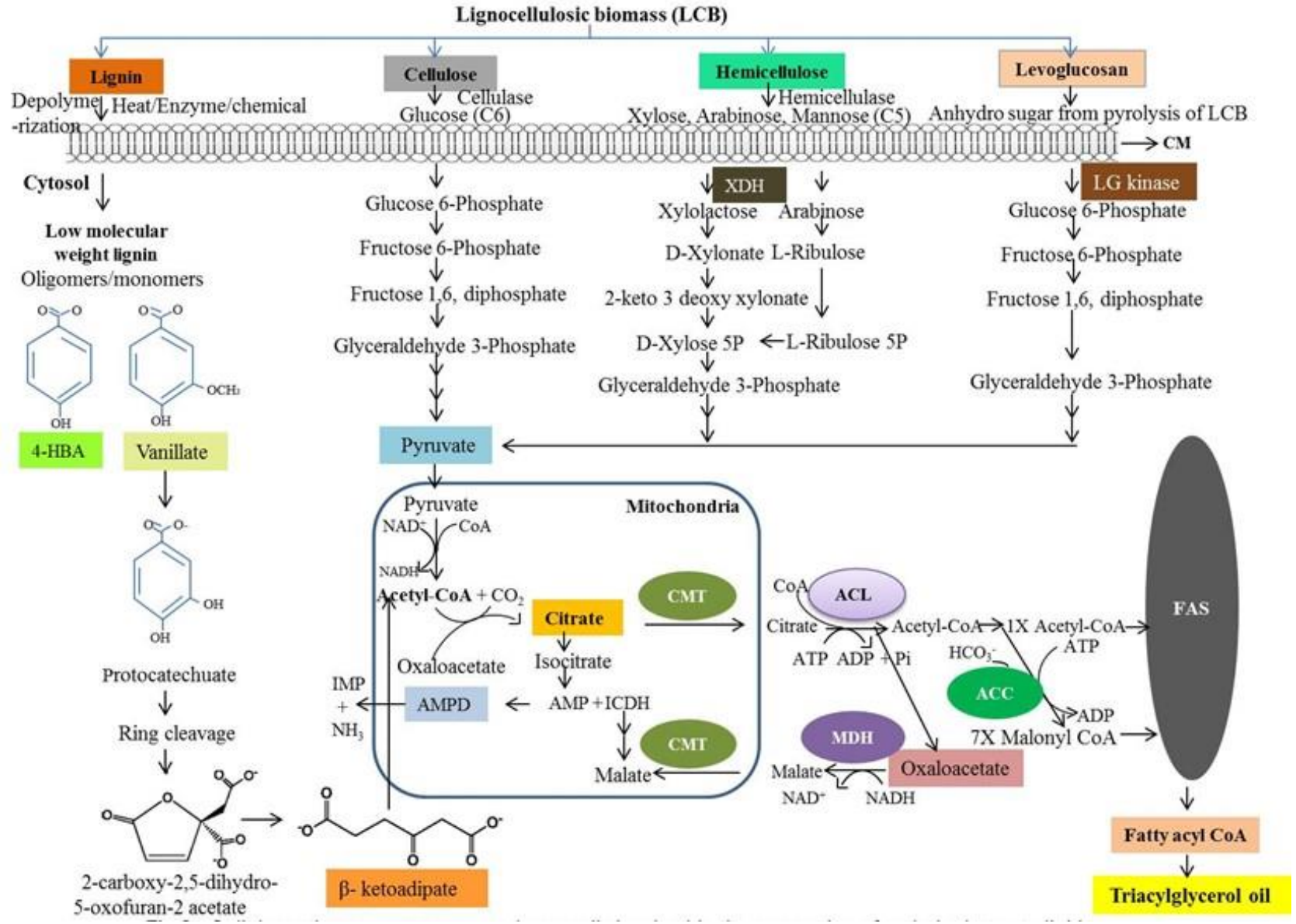
Microbial production of pigments using waste biomass



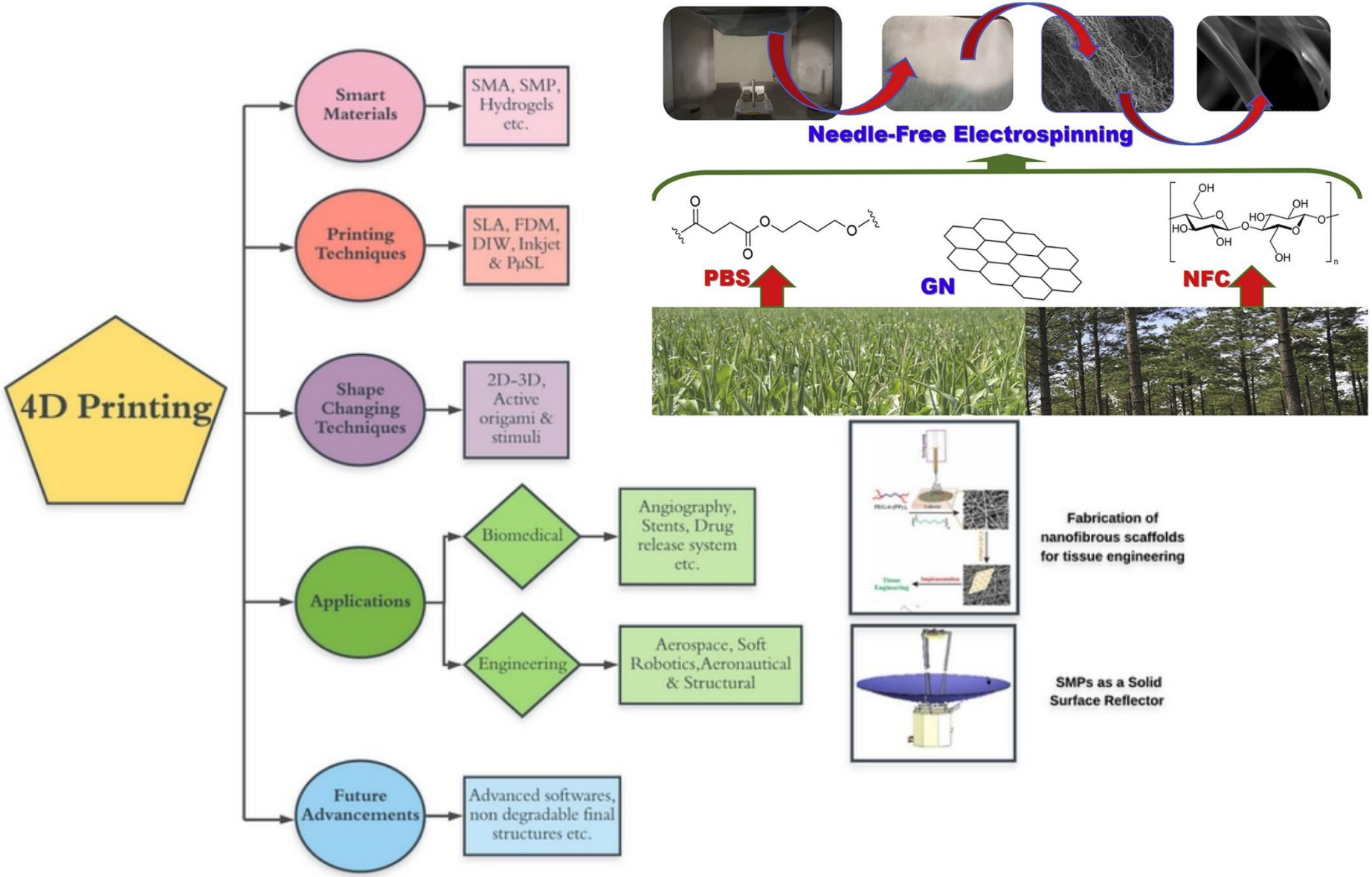
Microbial biodiesel production from lignocellulosic biomass

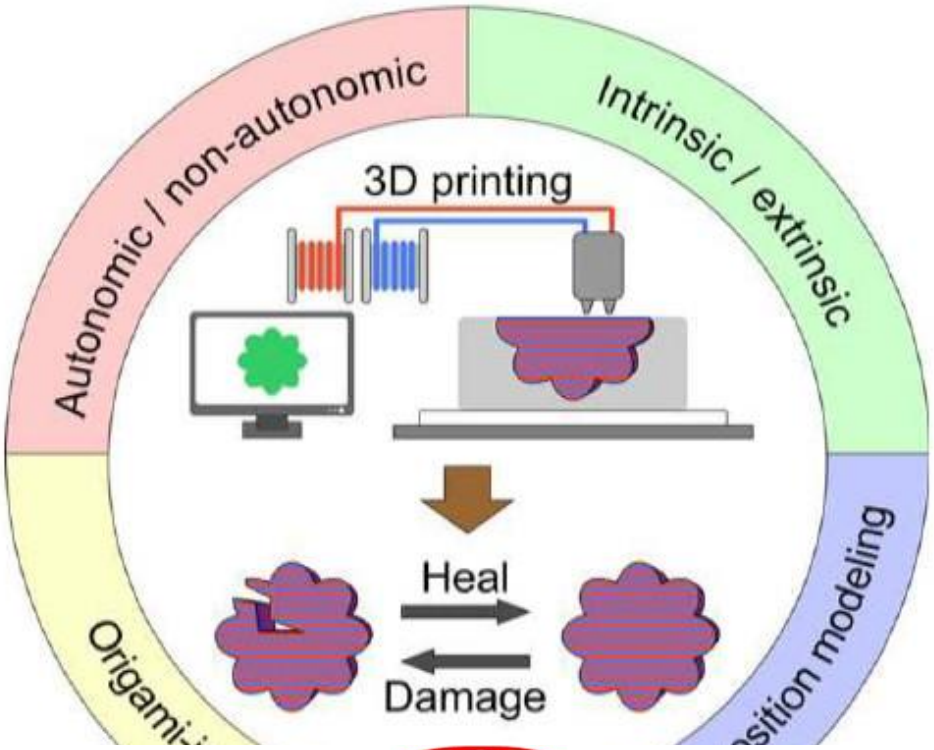


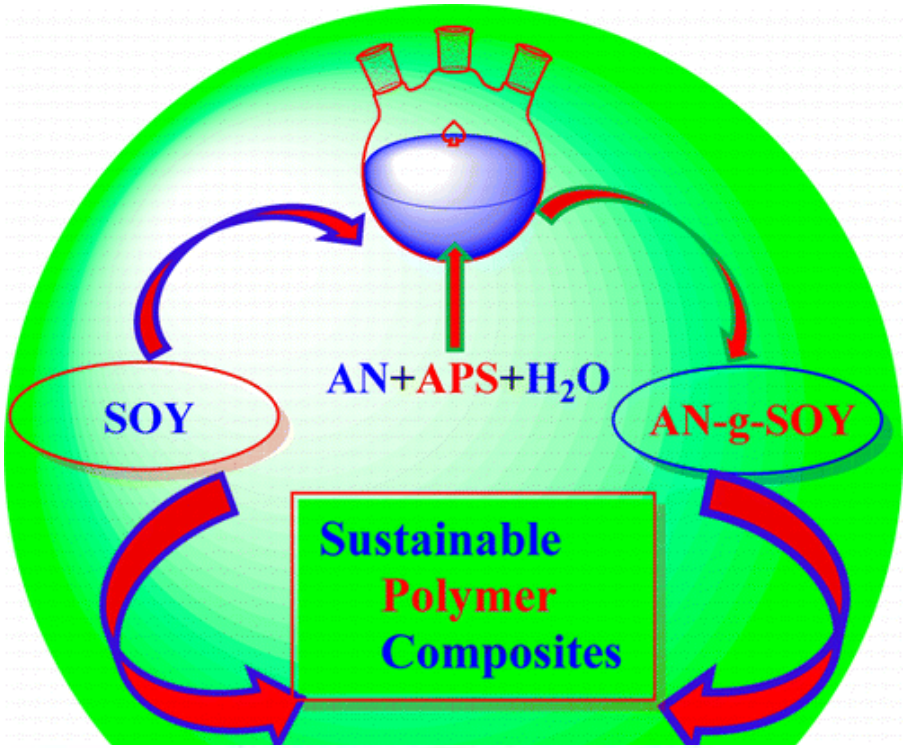
Cellular pathways, enzymes, and organelles involved in the carbohydrate to lipid conversion

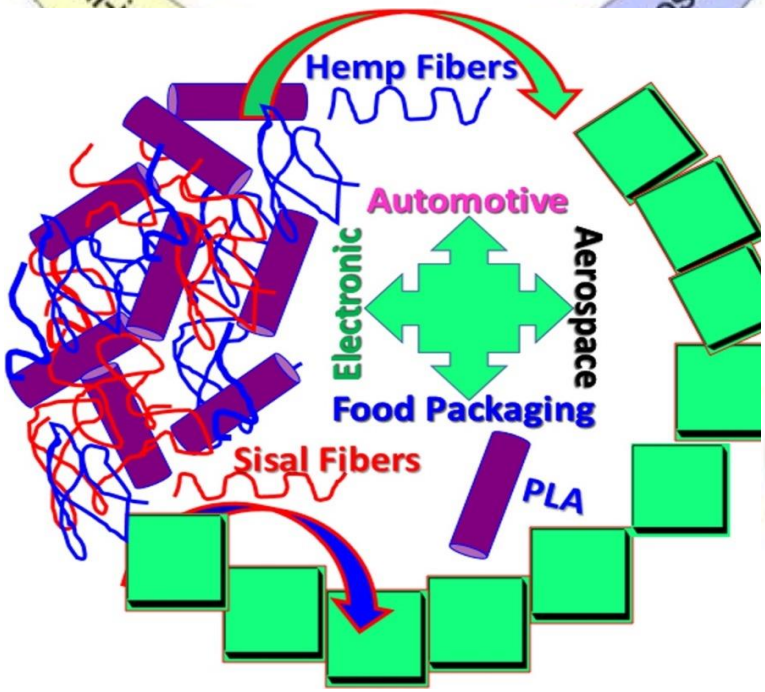


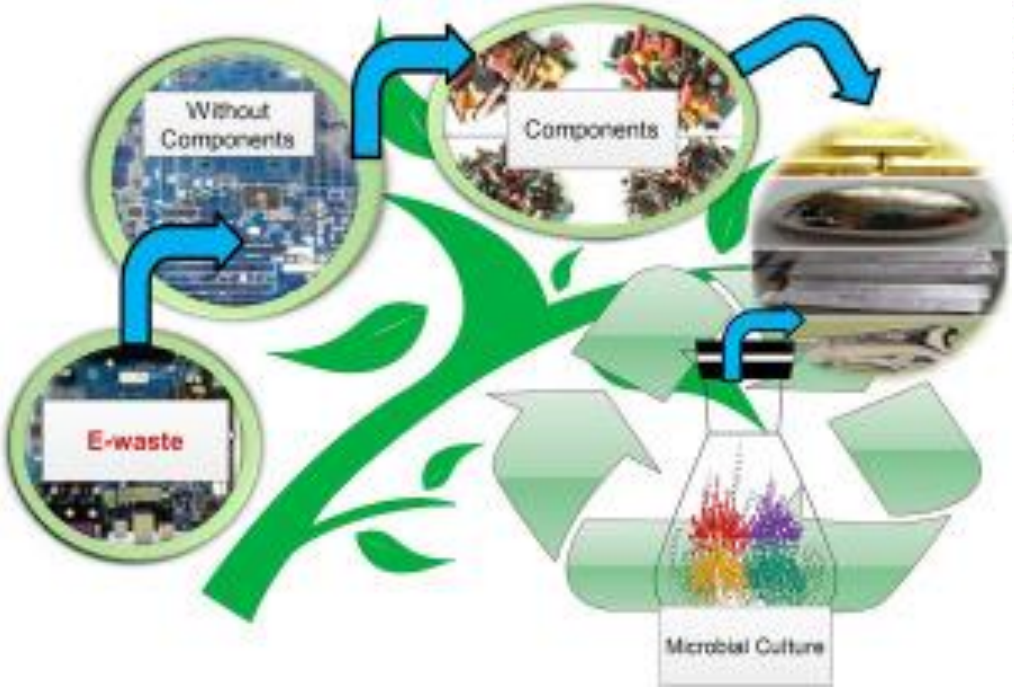
Additive Manufacturing of Advanced and Sustainable Materials



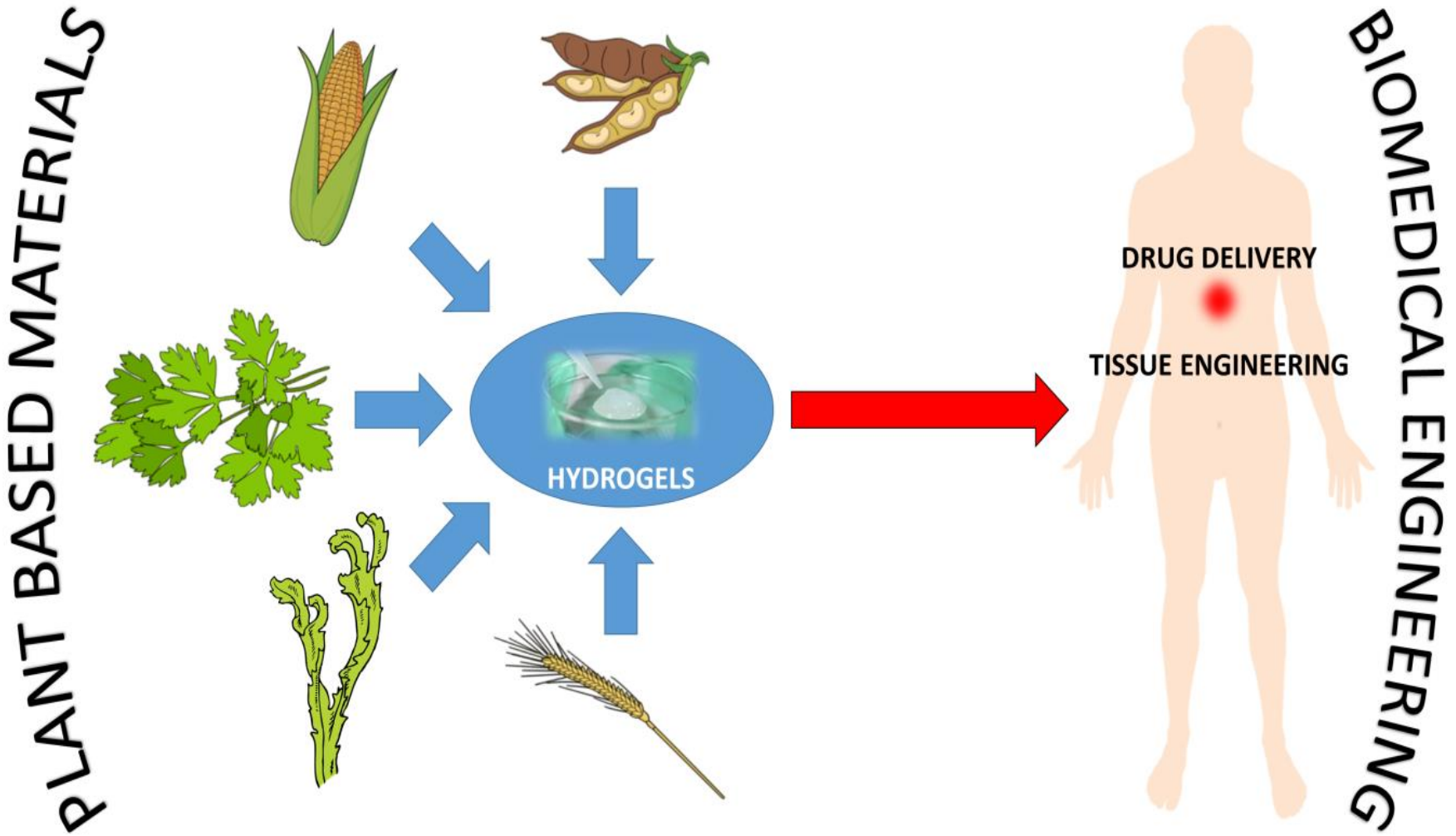

Autonomic / non-autonomic
Intrinsic / extrinsic
3D printing
Heal
Damage
sition modeling


AN+APS+H2O
SOY
AN-g-SOY
Sustainable
Polymer
Composites

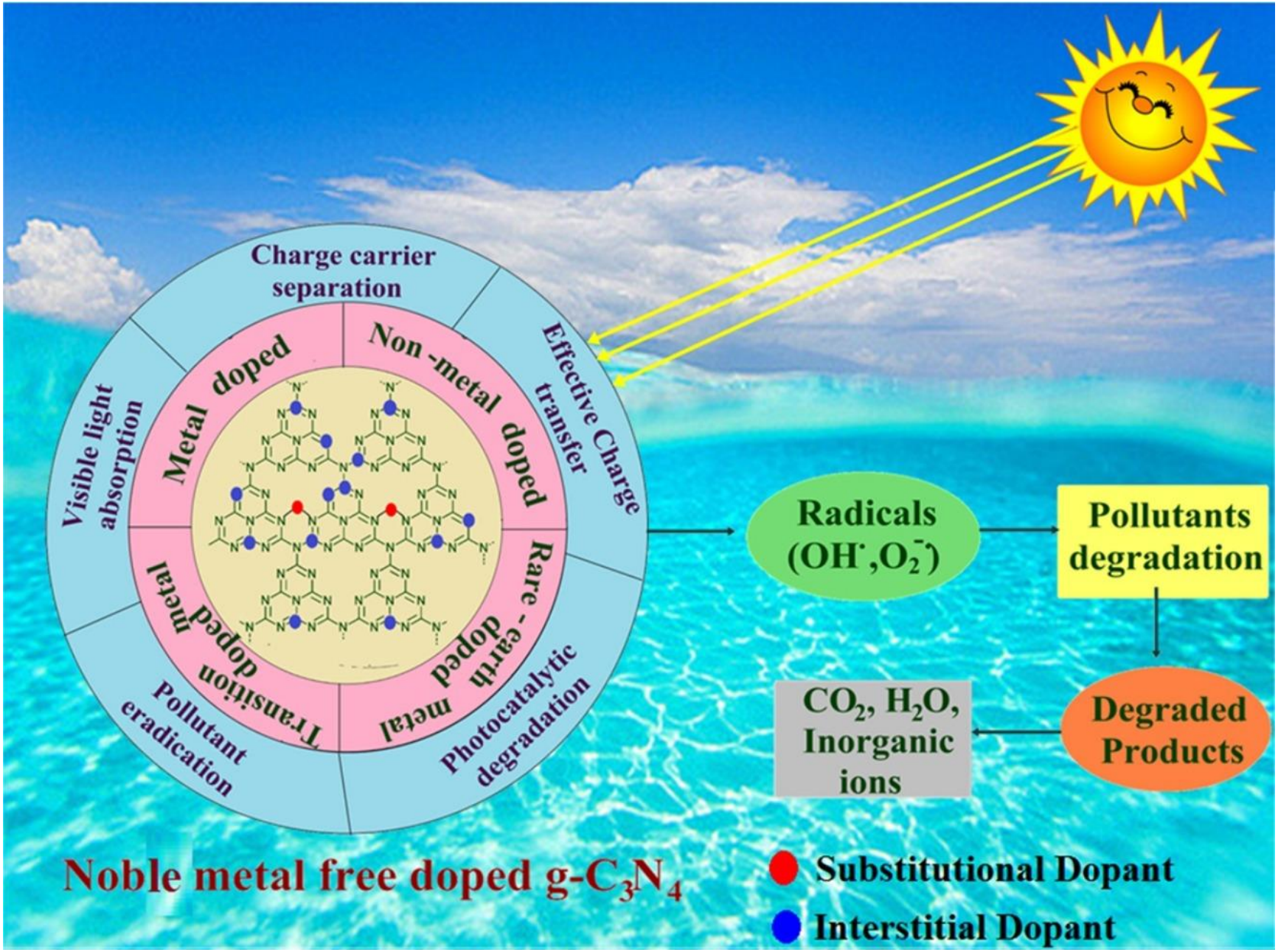

Hemp Fibers
Automotive
Electronic
Aerospace
Food Packaging
Sisal Fibers
PLA

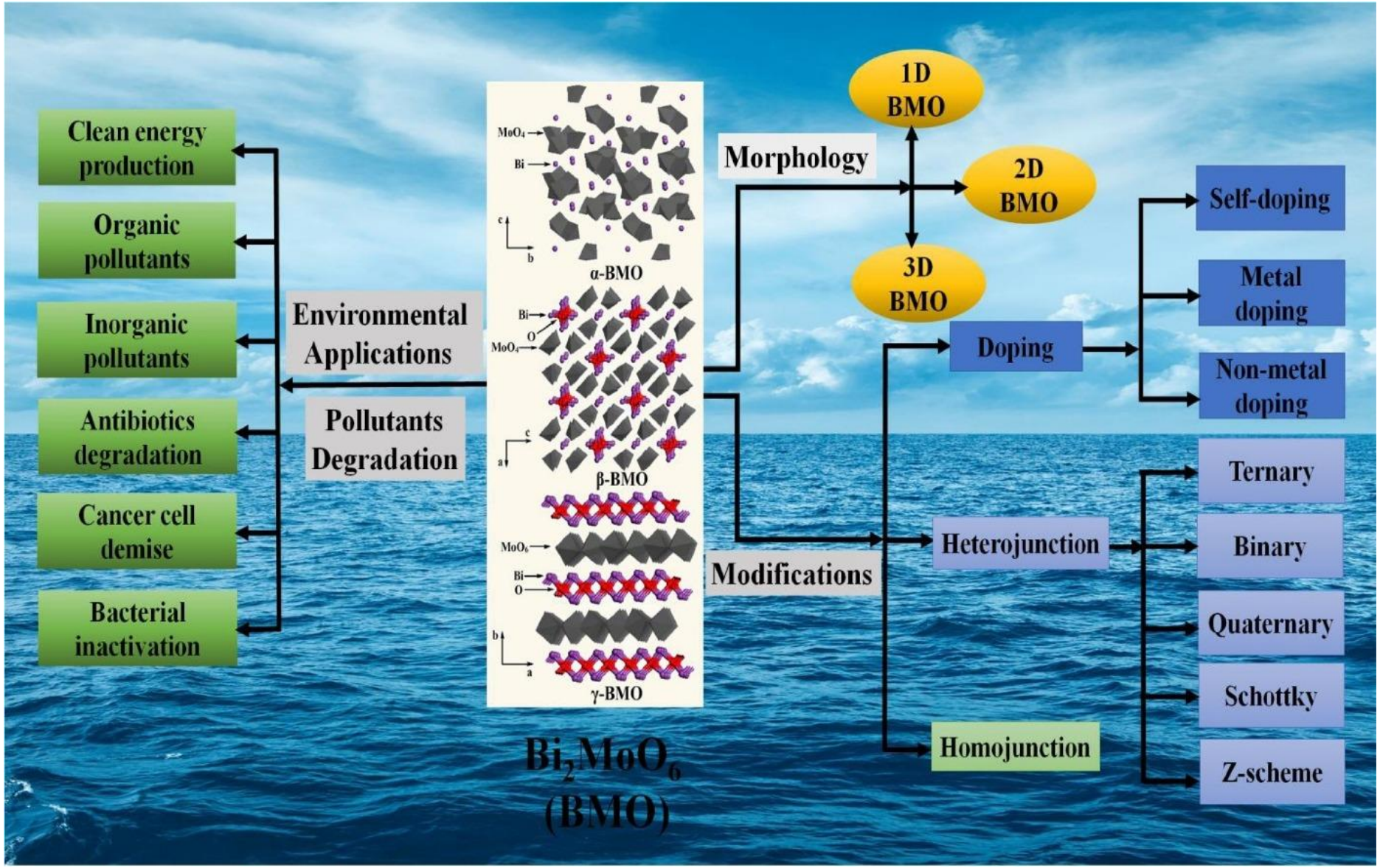

Without
Components
Components
E-waste
Microbial Culture

Plant-based green hydrogels in biomedical engineering and environmental applications

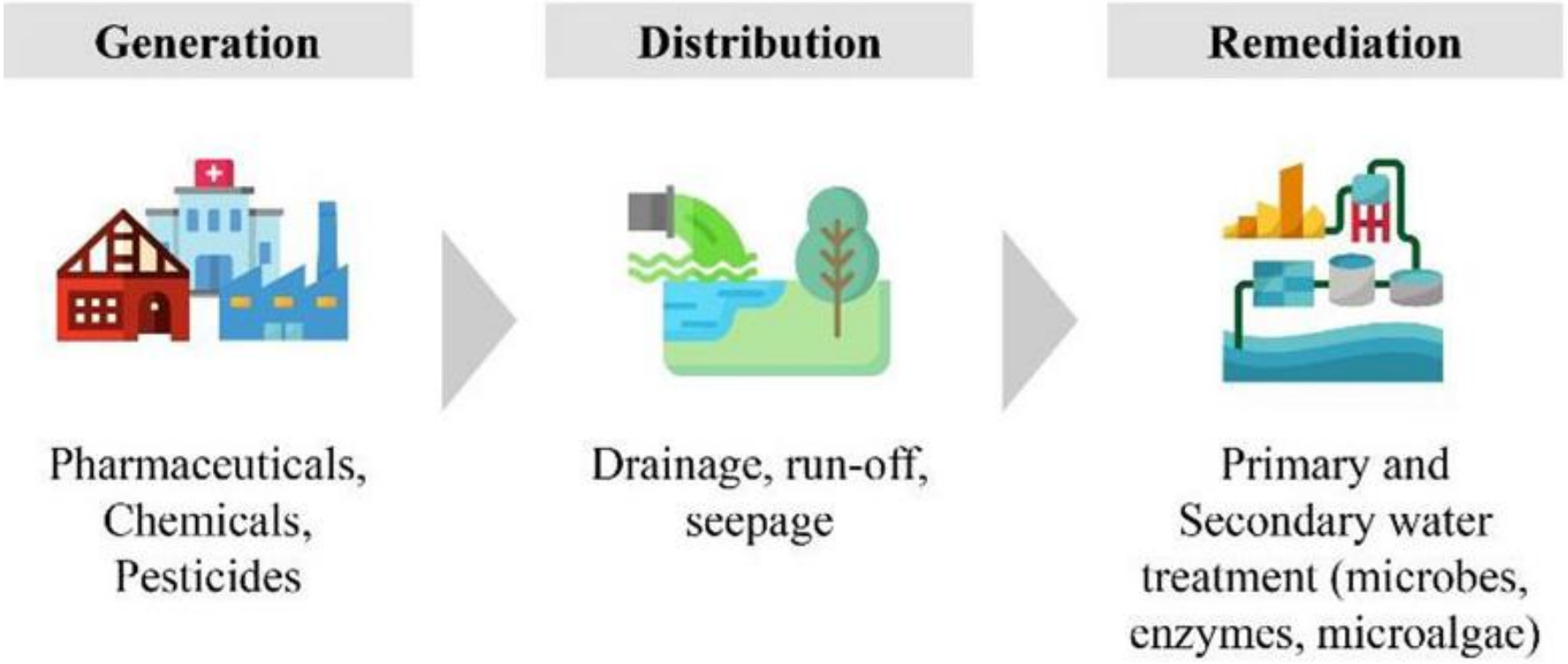


Next Generation photocatalysts for water treatment

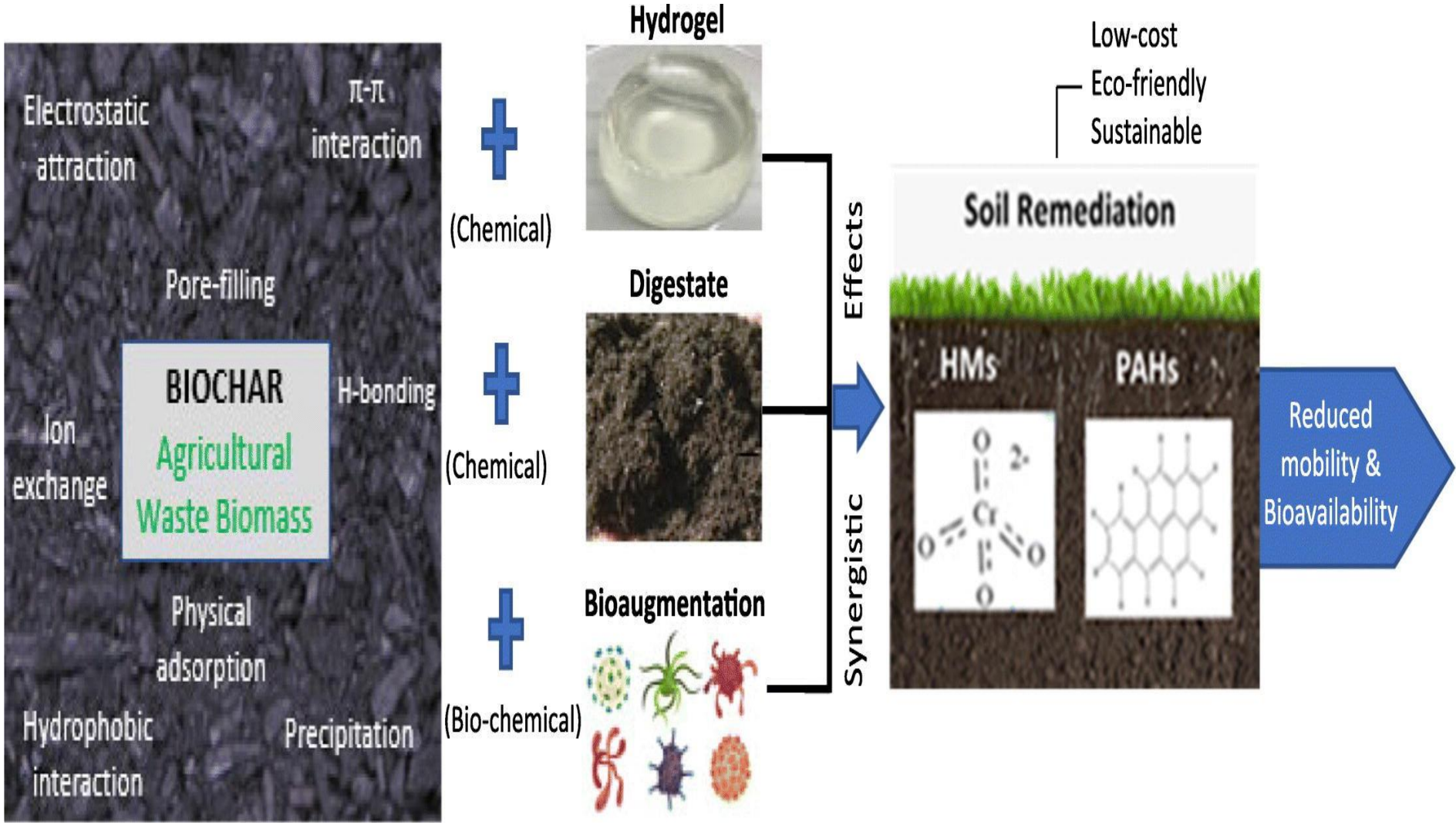



Clean energy production
Organic pollutants
Inorganic pollutants
Antibiotics degradation
Cancer cell demise
Bacterial inactivation
Environmental Applications
Pollutants Degradation
α-BMO
β-BMO
γ-BMO
Bi2MoO6 (BMO)
Morphology
1D BMO
2D BMO
3D BMO
Modifications
Doping
Self-doping
Metal doping
Non-metal doping
Heterojunction
Ternary
Binary
Quaternary
Schottky
Z-scheme
Homojunction

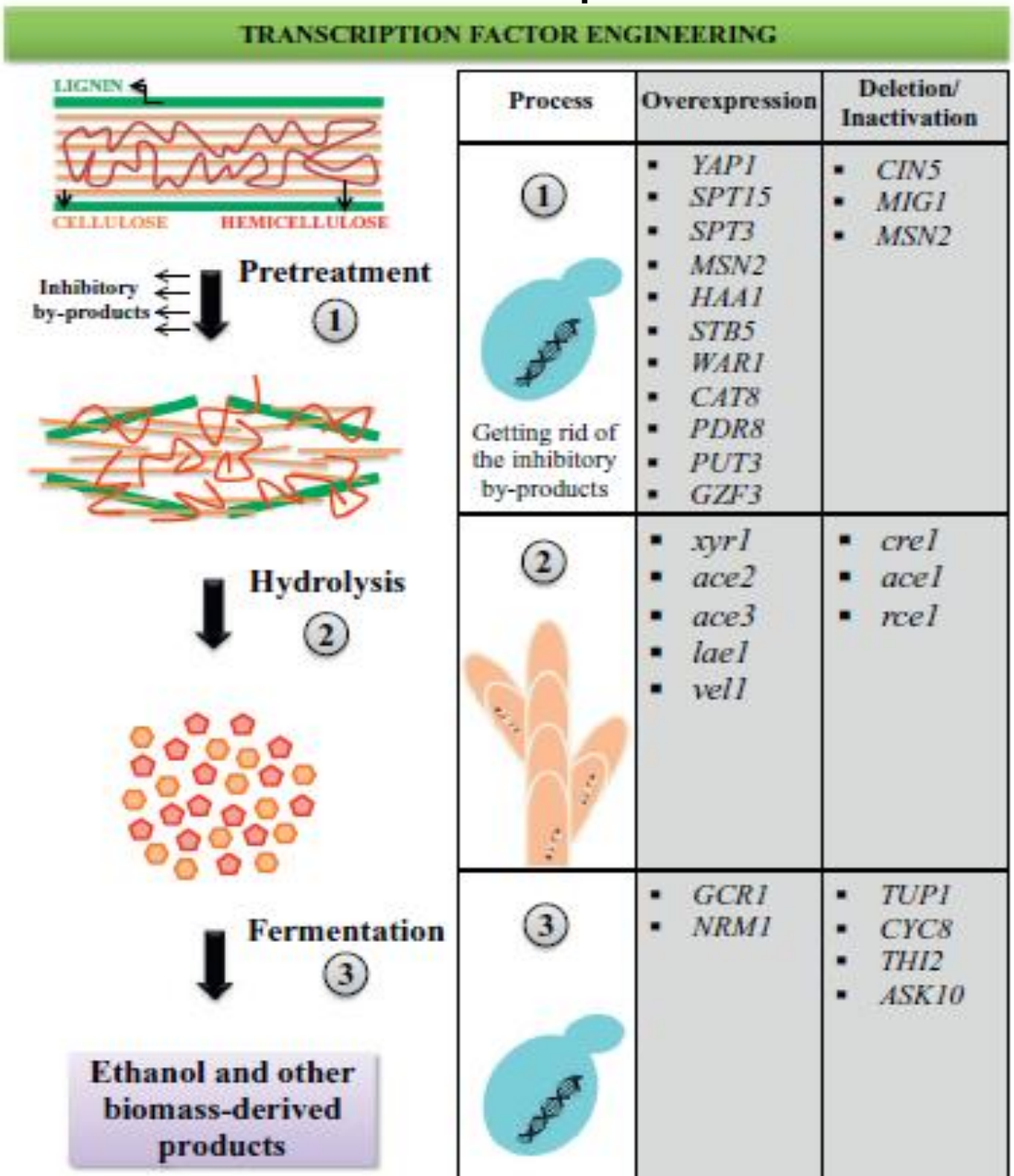
Enzyme and microalgae based biotechniques to remediate micropollutants from aqueous systems



Engineering Biochar for Soil Contaminated with Complex Chemical Mixtures



Transcription factor engineering to improve plant cell wall degradation and fermentative process



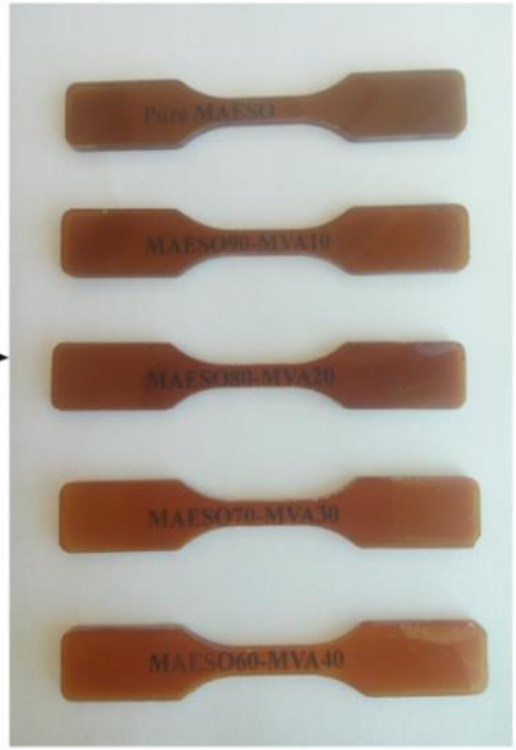
Bio-based Sustainable Monomers and Polymers

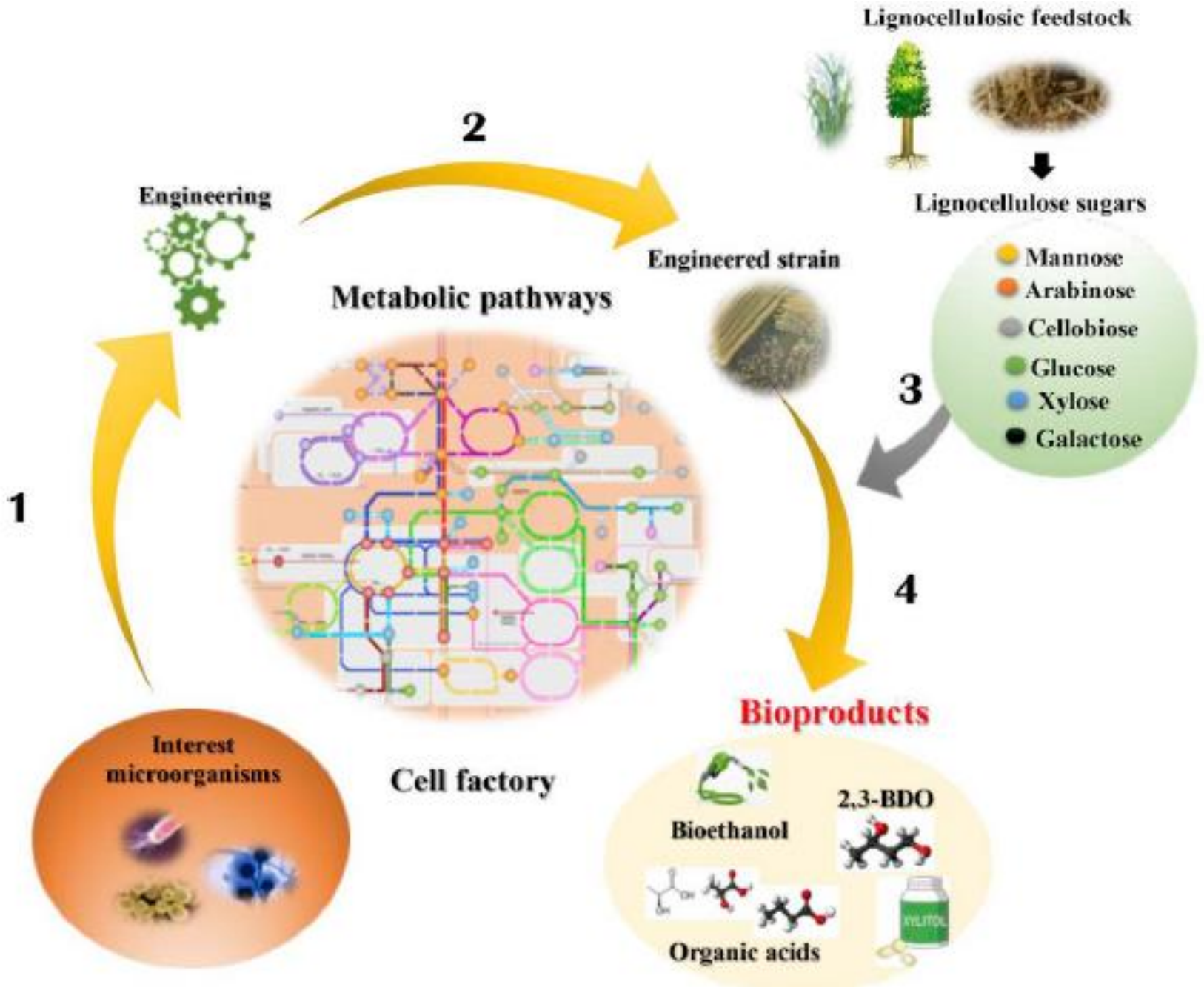
Vanilla

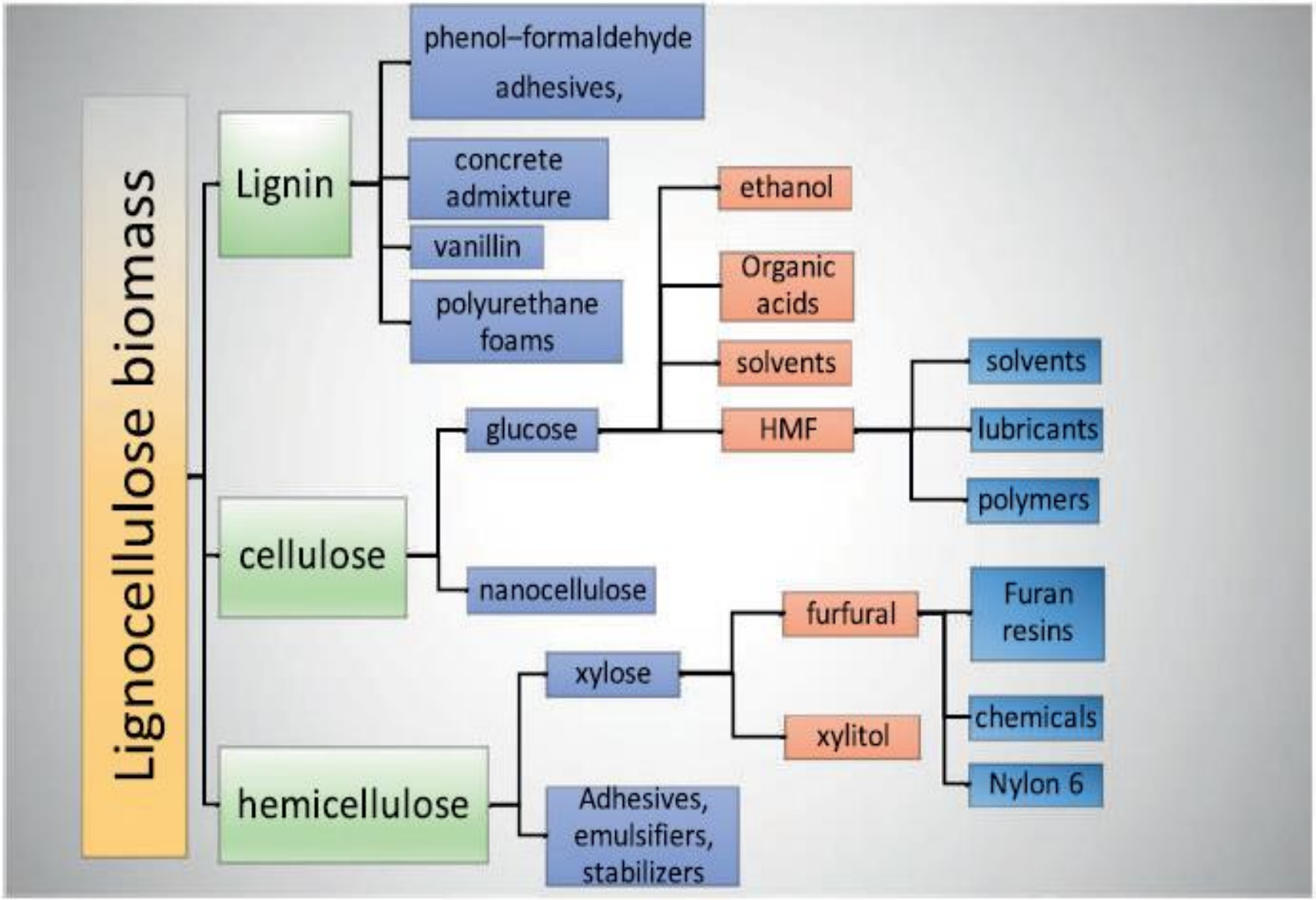
Clove

Mixing

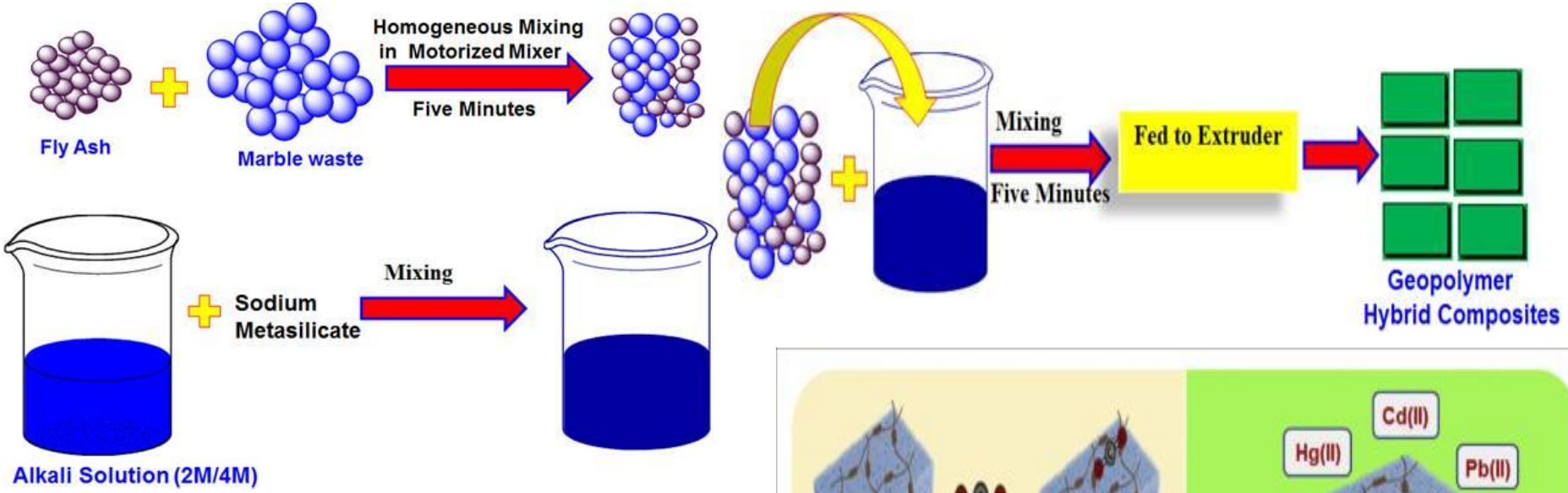
Curing

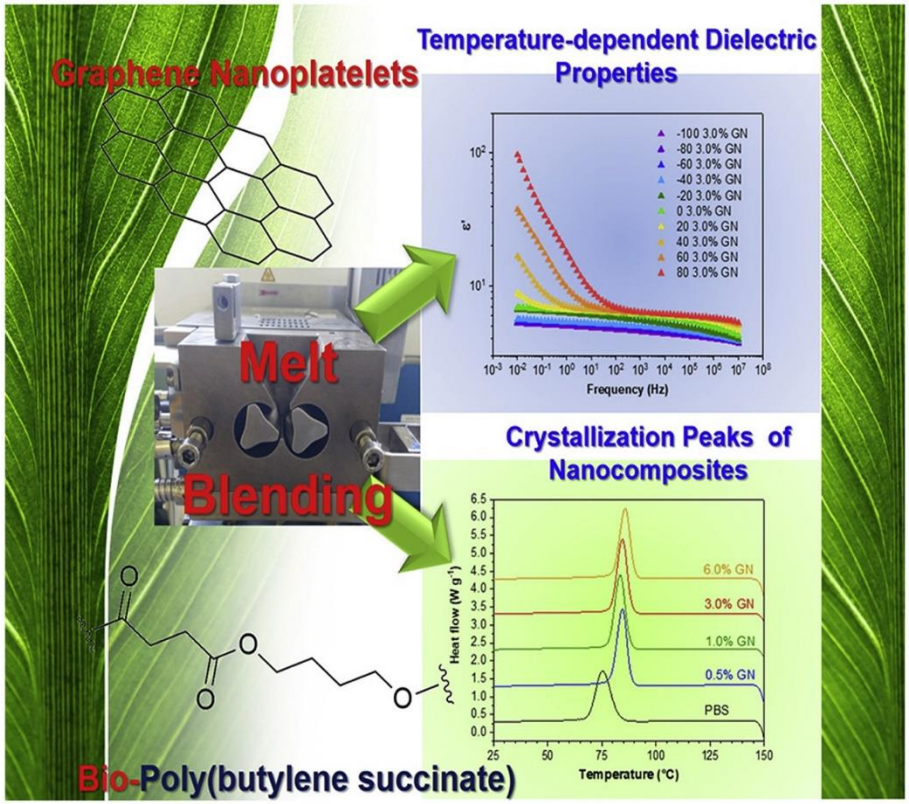


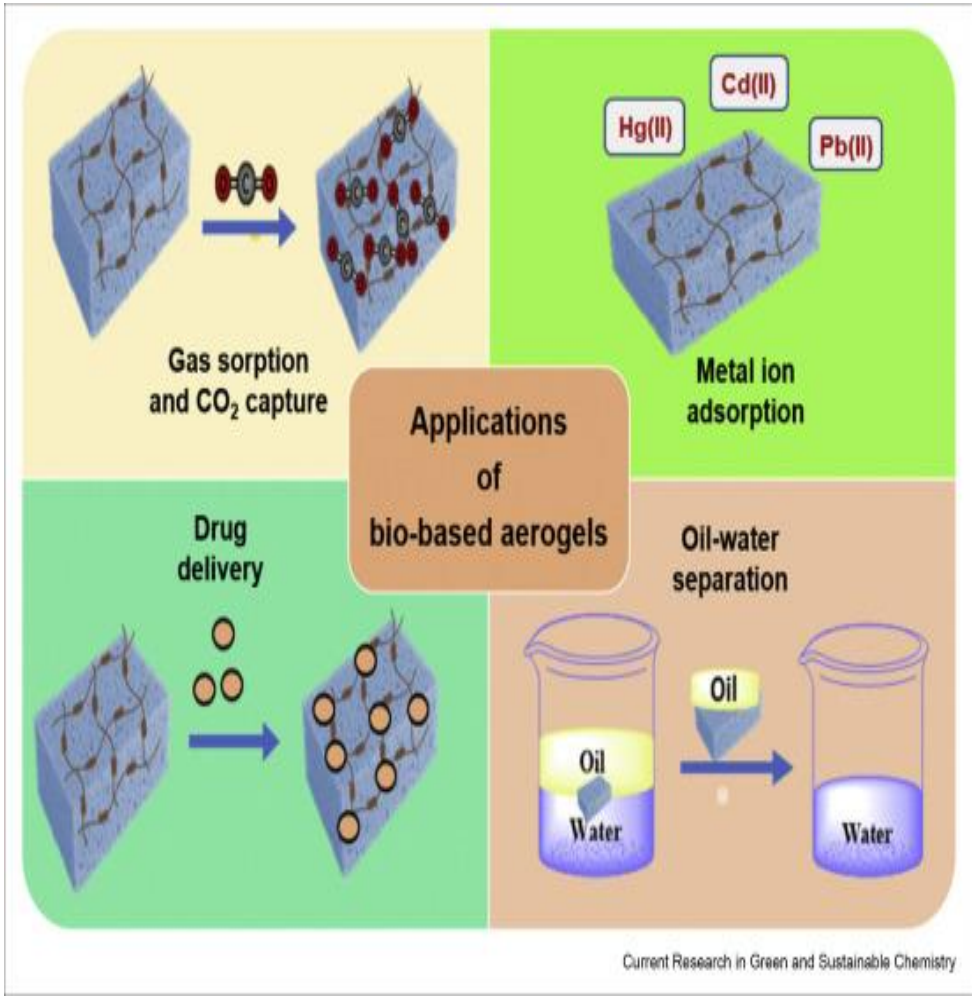

Lignocellulosic feedstock
Lignocellulose sugars
Mannose
Arabinose
Cellobiose
Glucose
Xylose
Galactose
2
Engineering
Engineered strain
Metabolic pathways
3
1
4
Bioproducts
Interest microorganisms
Cell factory
Bioethanol
2,3-BDO
Organic acids
XYLITOL


Lignocellulose biomass
Lignin
phenol–formaldehyde adhesives,
concrete admixture
vanillin
polyurethane foams
cellulose
glucose
ethanol
Organic acids
solvents
HMF
solvents
lubricants
polymers
nanocellulose
hemicellulose
xylose
furfural
Furan resins
xylitol
chemicals
Nylon 6
Adhesives, emulsifiers, stabilizers

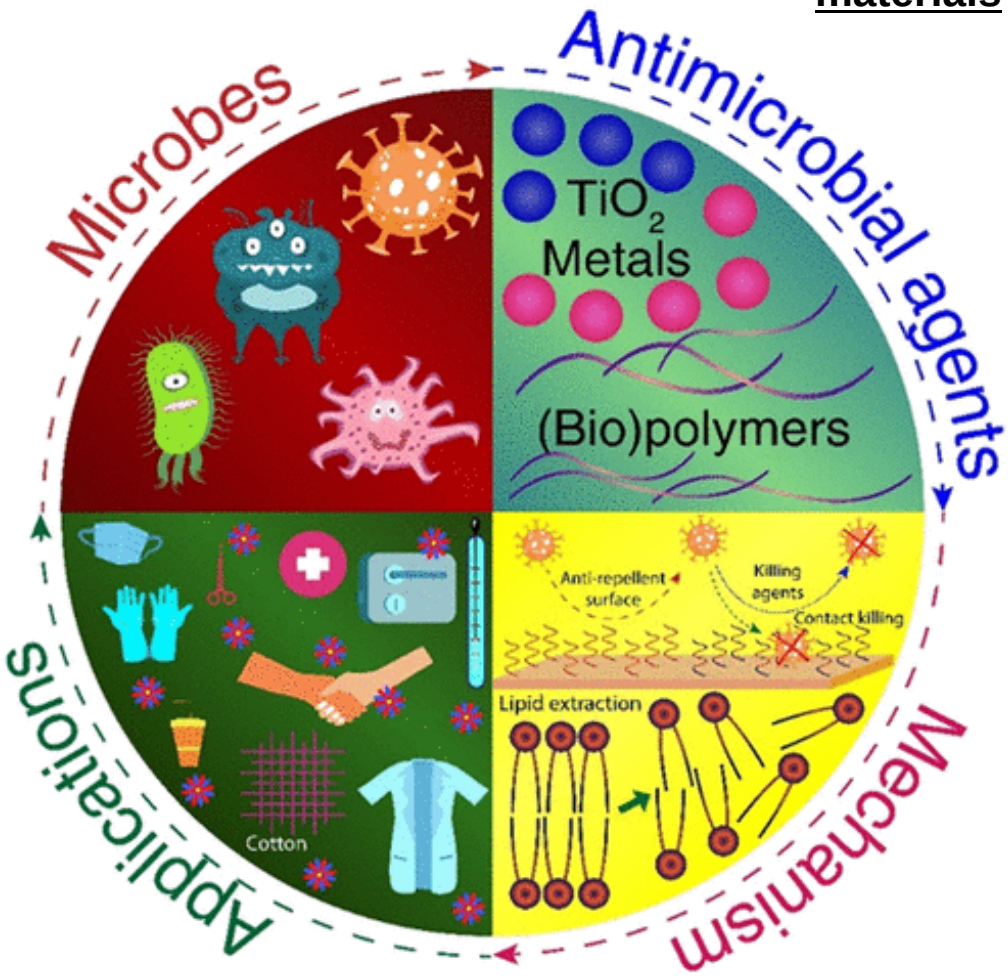
Sustainable composite materials for a circular economy

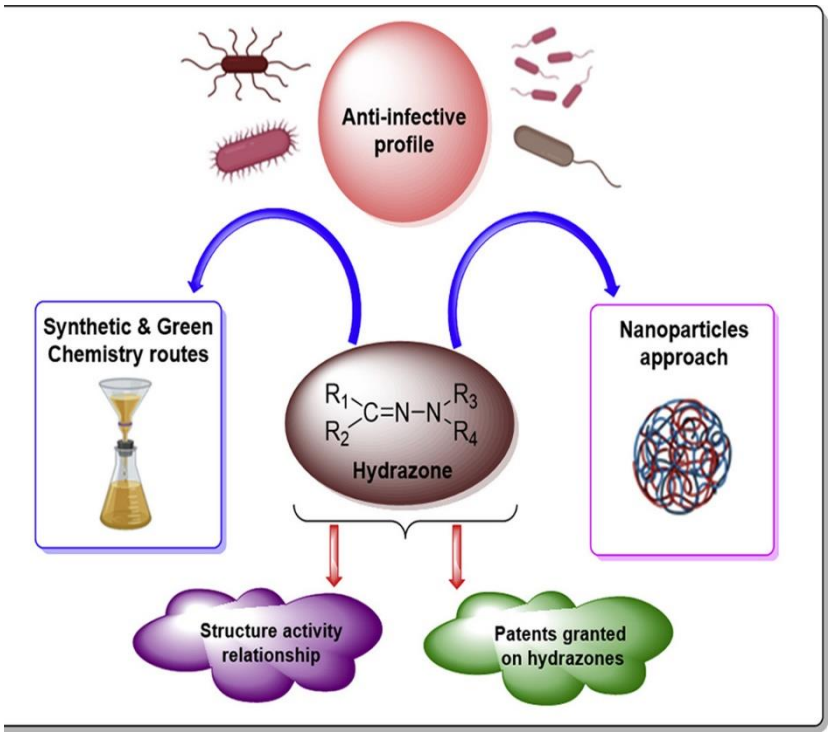

Fly Ash
Marble waste
Homogeneous Mixing in Motorized Mixer
Five Minutes
Mixing
Five Minutes
Fed to Extruder
Geopolymer Hybrid Composites
Sodium Metasilicate
Mixing
Alkali Solution (2M/4M)

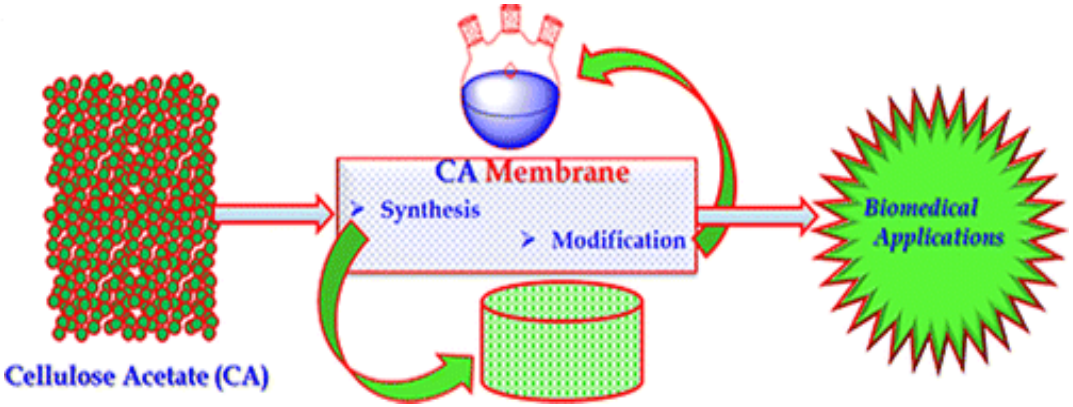

Graphene Nanoplatelets
Melt Blending
Temperature-dependent Dielectric Properties
-100 3.0% GN
-80 3.0% GN
-60 3.0% GN
-40 3.0% GN
-20 3.0% GN
0 3.0% GN
20 3.0% GN
40 3.0% GN
60 3.0% GN
80 3.0% GN
ε'
Frequency (Hz)
Crystallization Peaks of Nanocomposites
6.0% GN
3.0% GN
1.0% GN
0.5% GN
PBS
Heat flow (W g⁻¹)
Temperature (°C)
Bio-Poly(butylene succinate)

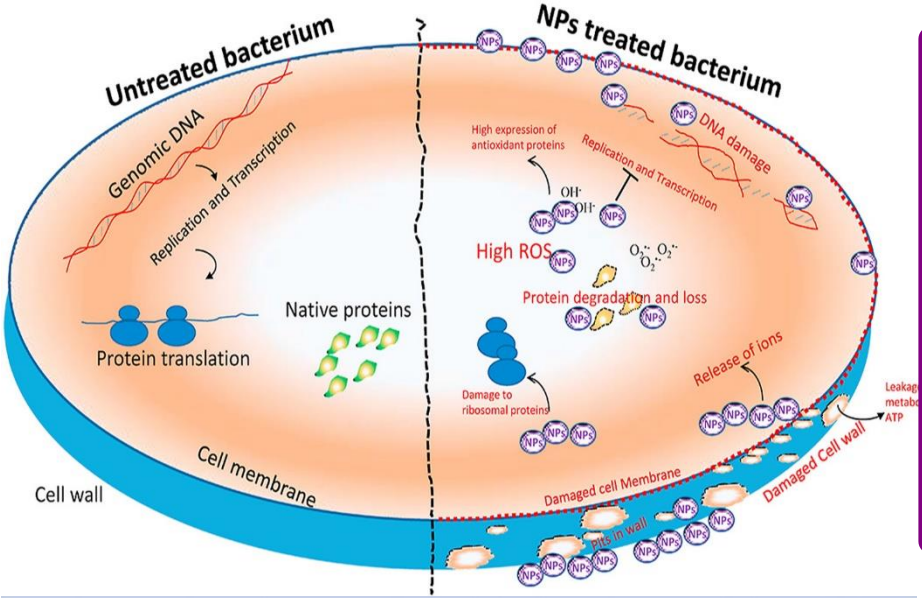

Gas sorption and CO_2 capture
Cd(II)
Hg(II)
Pb(II)
Metal ion adsorption
Applications of bio-based aerogels
Drug delivery
Oil-water separation
Oil
Water
Oil
Water
Current Research in Green and Sustainable Chemistry

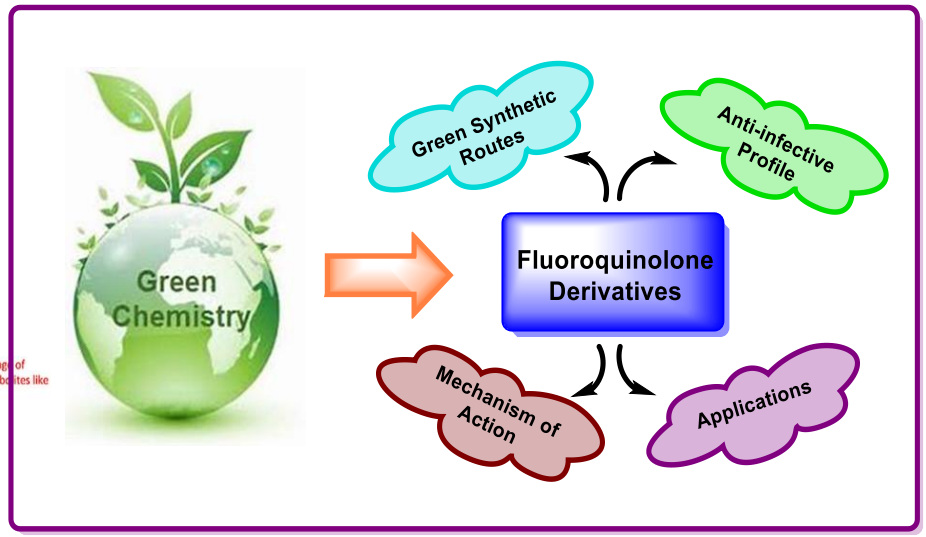
New approaches towards the design and synthesis of antiviral and antimicrobial materials

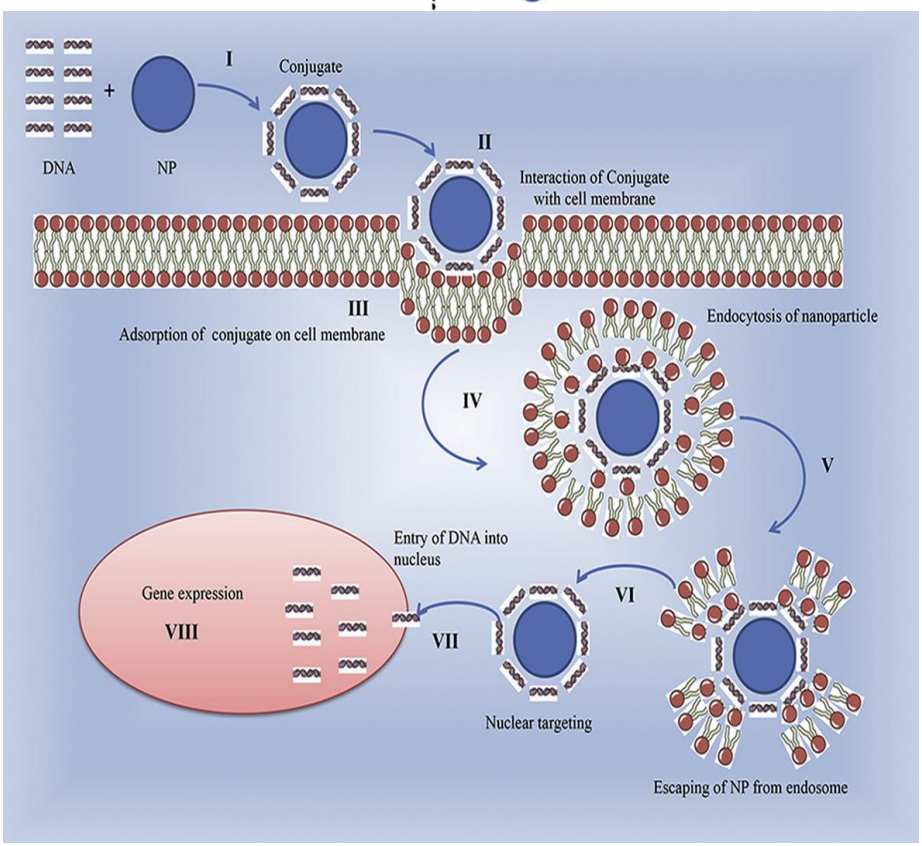


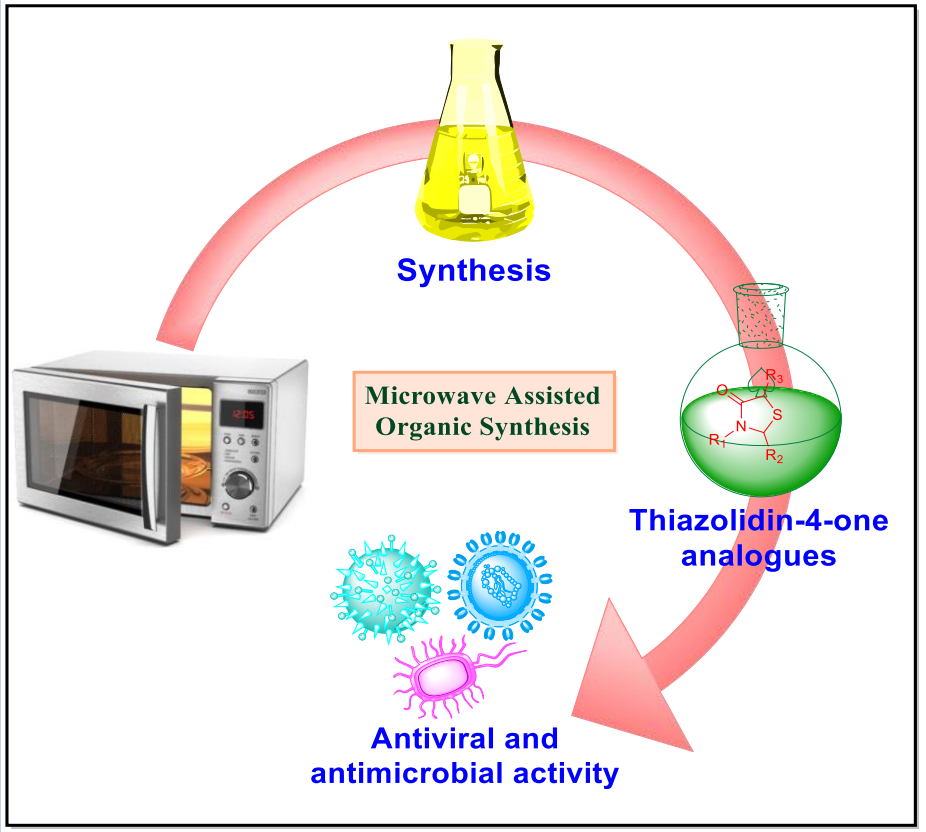


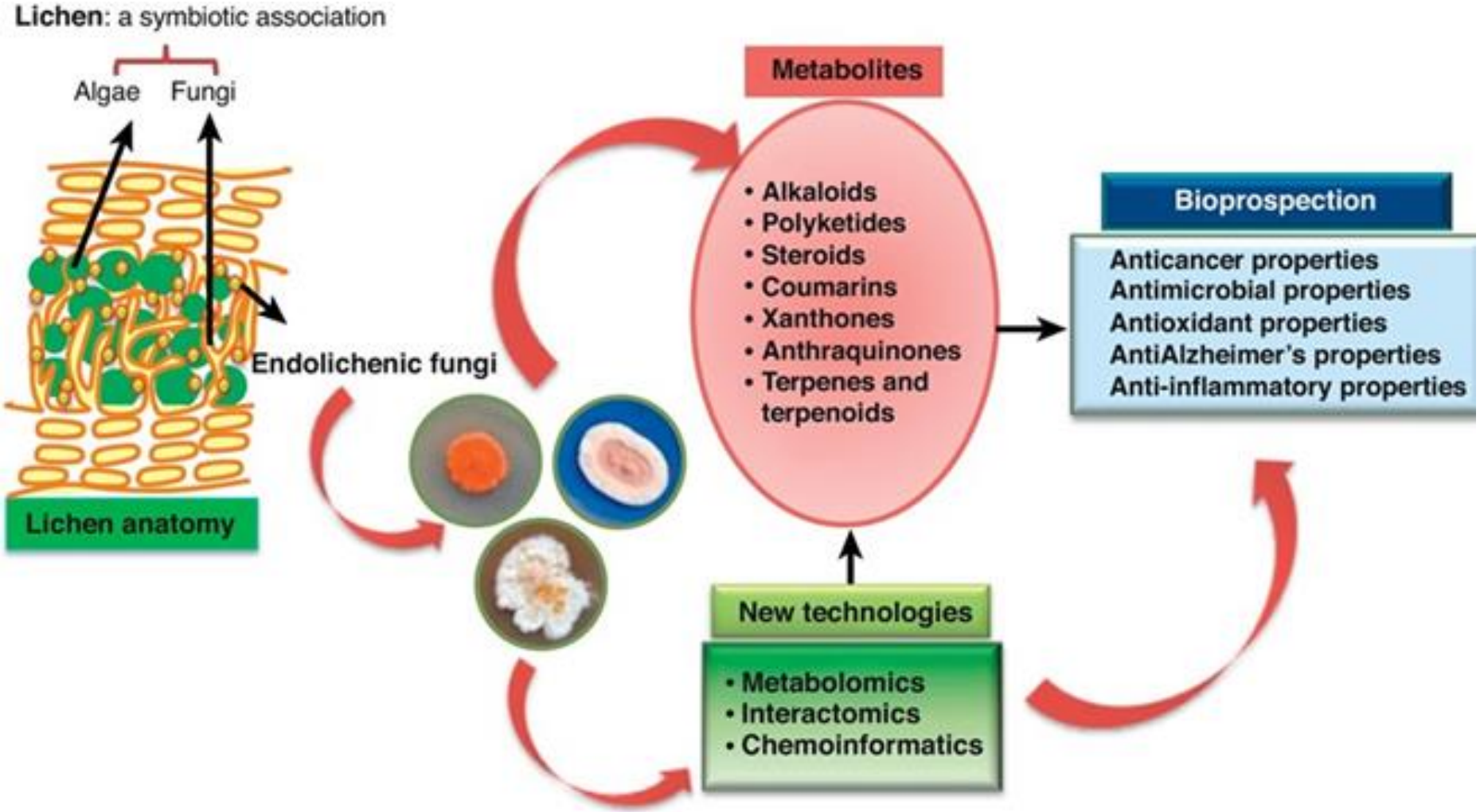



Untreated bacterium
NPs treated bacterium
Genomic DNA
Replication and Transcription
Native proteins
Protein translation
Cell wall
Cell membrane
High expression of antioxidant proteins
Replication and Transcription
DNA damage
High ROS
Protein degradation and loss
Damage to ribosomal proteins
Release of ions
Leakage of metabolites like ATP
Damaged cell Membrane
Damaged Cell wall
Pits in wall

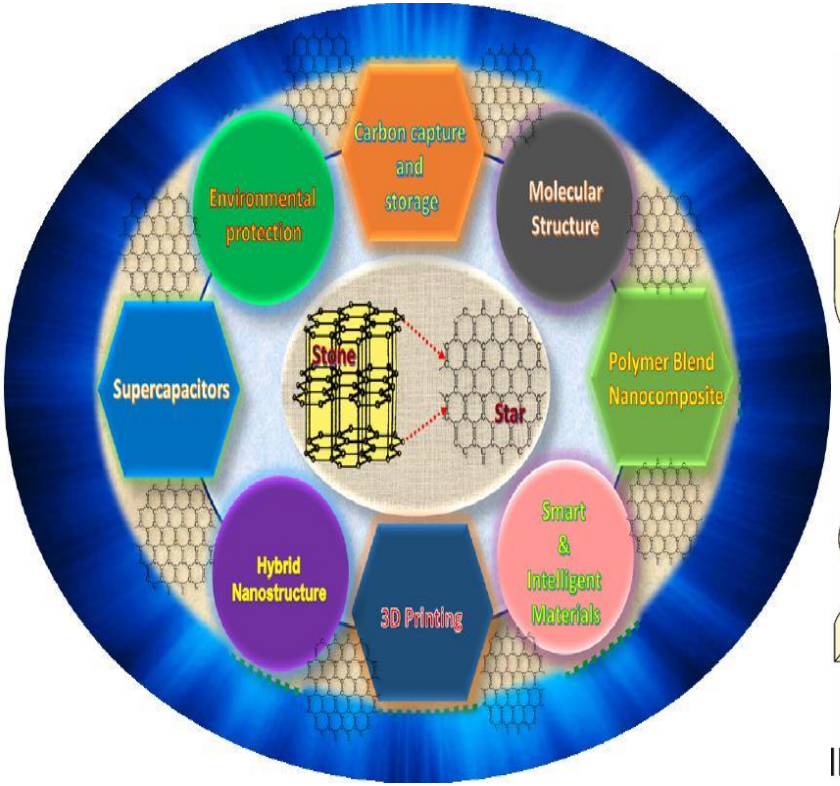

Green Chemistry
Green Synthetic Routes
Anti-infective Profile
Fluoroquinolone Derivatives
Mechanism of Action
Applications

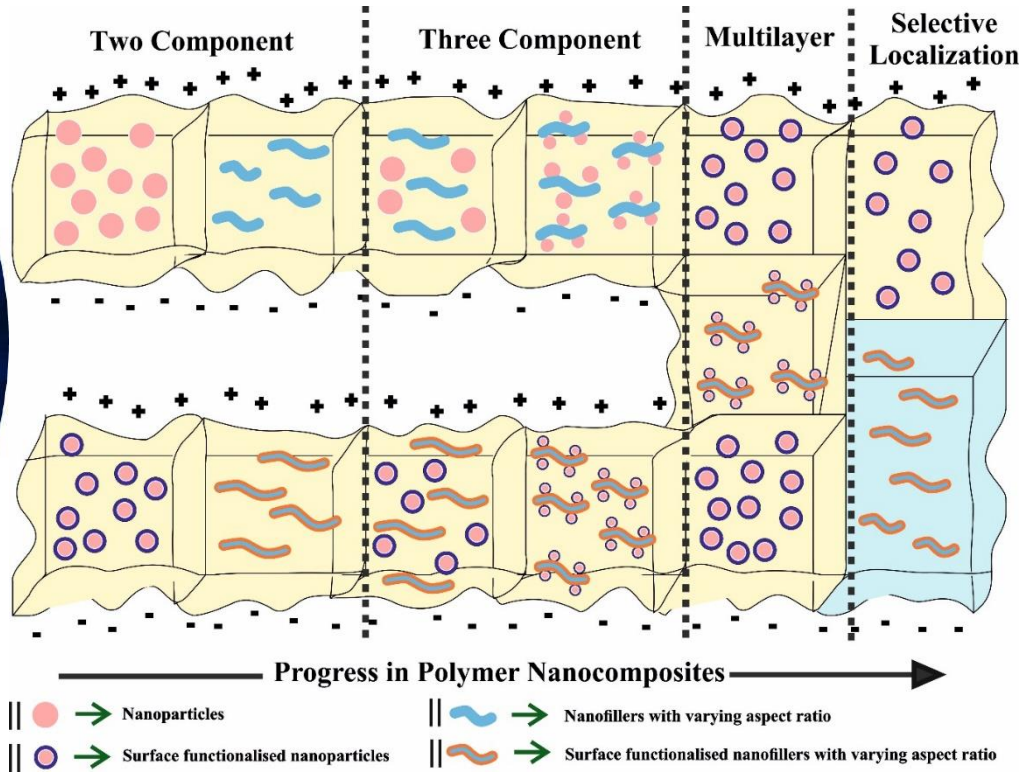

DNA
NP
I
Conjugate
II
Interaction of Conjugate with cell membrane
III
Adsorption of conjugate on cell membrane
Endocytosis of nanoparticle
IV
V
Entry of DNA into nucleus
VI
VII
Nuclear targeting
Escaping of NP from endosome
Gene expression
VIII

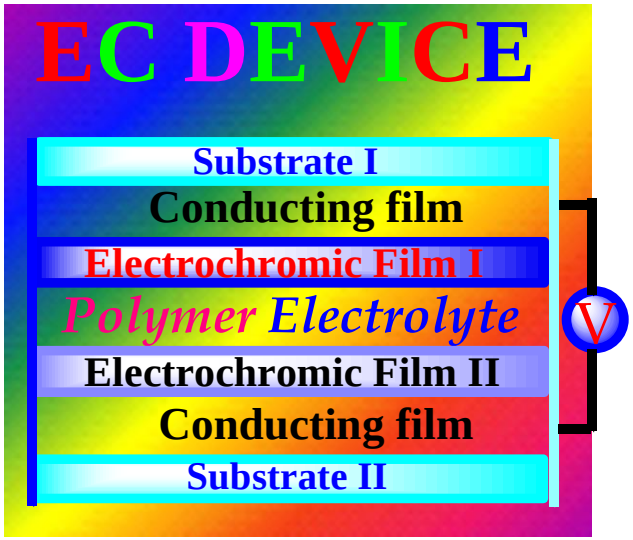

Synthesis
Microwave Assisted Organic Synthesis
Thiazolidin-4-one analogues
Antiviral and antimicrobial activity

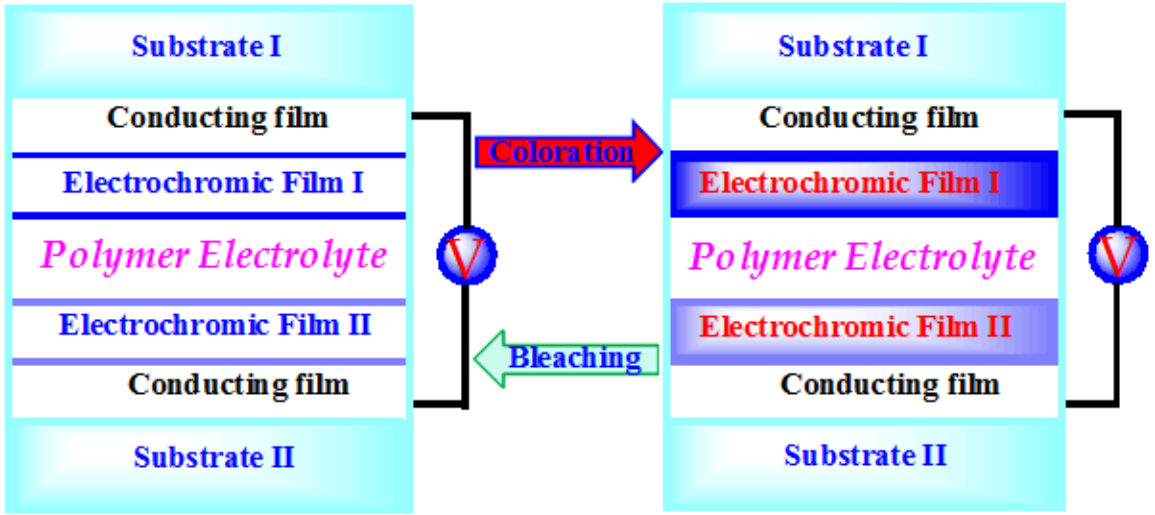

Lichen: a symbiotic association
Algae
Fungi
Lichen anatomy
Endolichenic fungi
Metabolites
• Alkaloids
• Polyketides
• Steroids
• Coumarins
• Xanthones
• Anthraquinones
• Terpenes and terpenoids
Bioprospection
Anticancer properties
Antimicrobial properties
Antioxidant properties
AntiAlzheimer's properties
Anti-inflammatory properties
New technologies
• Metabolomics
• Interactomics
• Chemoinformatics

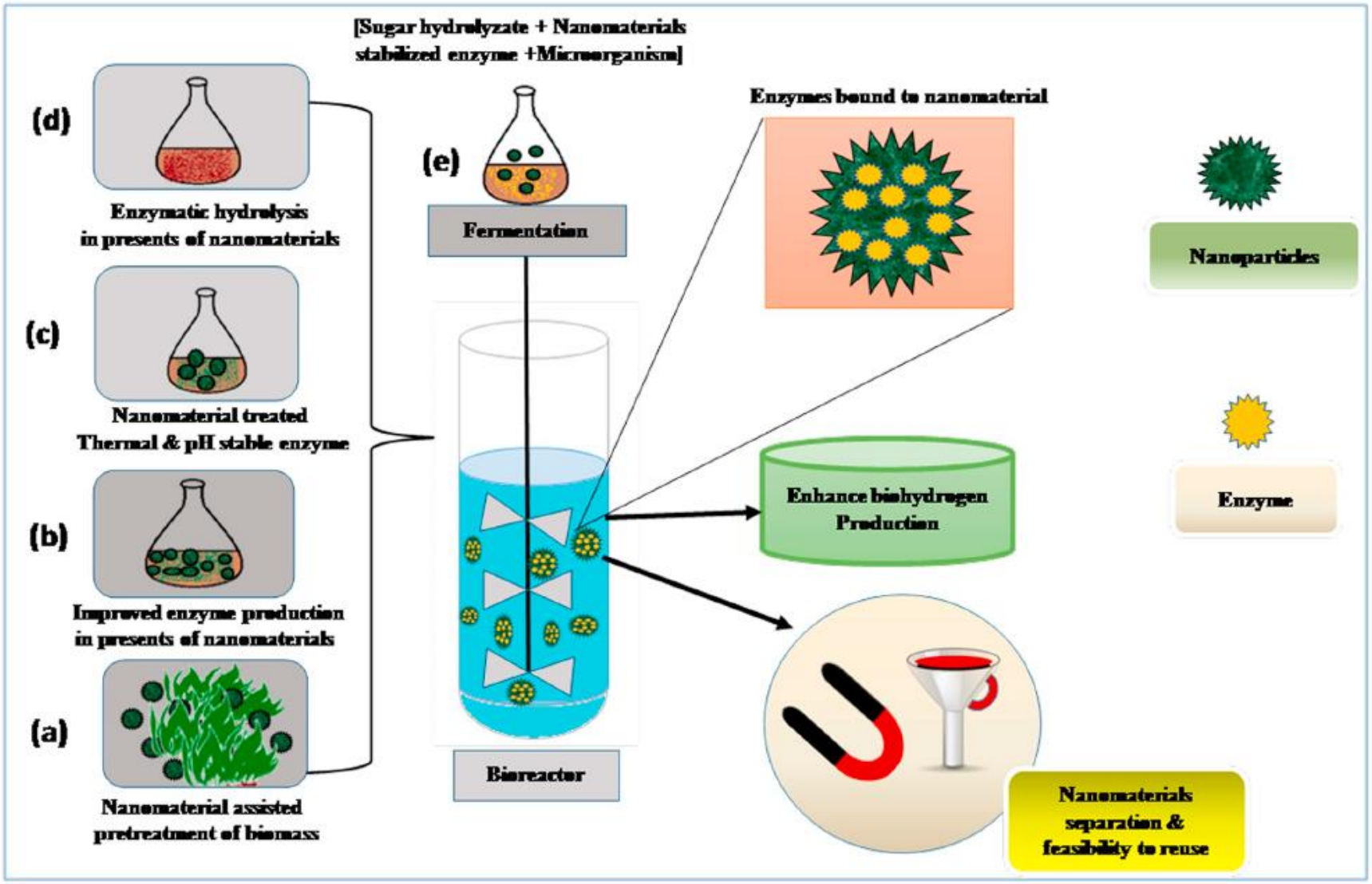
New Materials for Advanced Applications

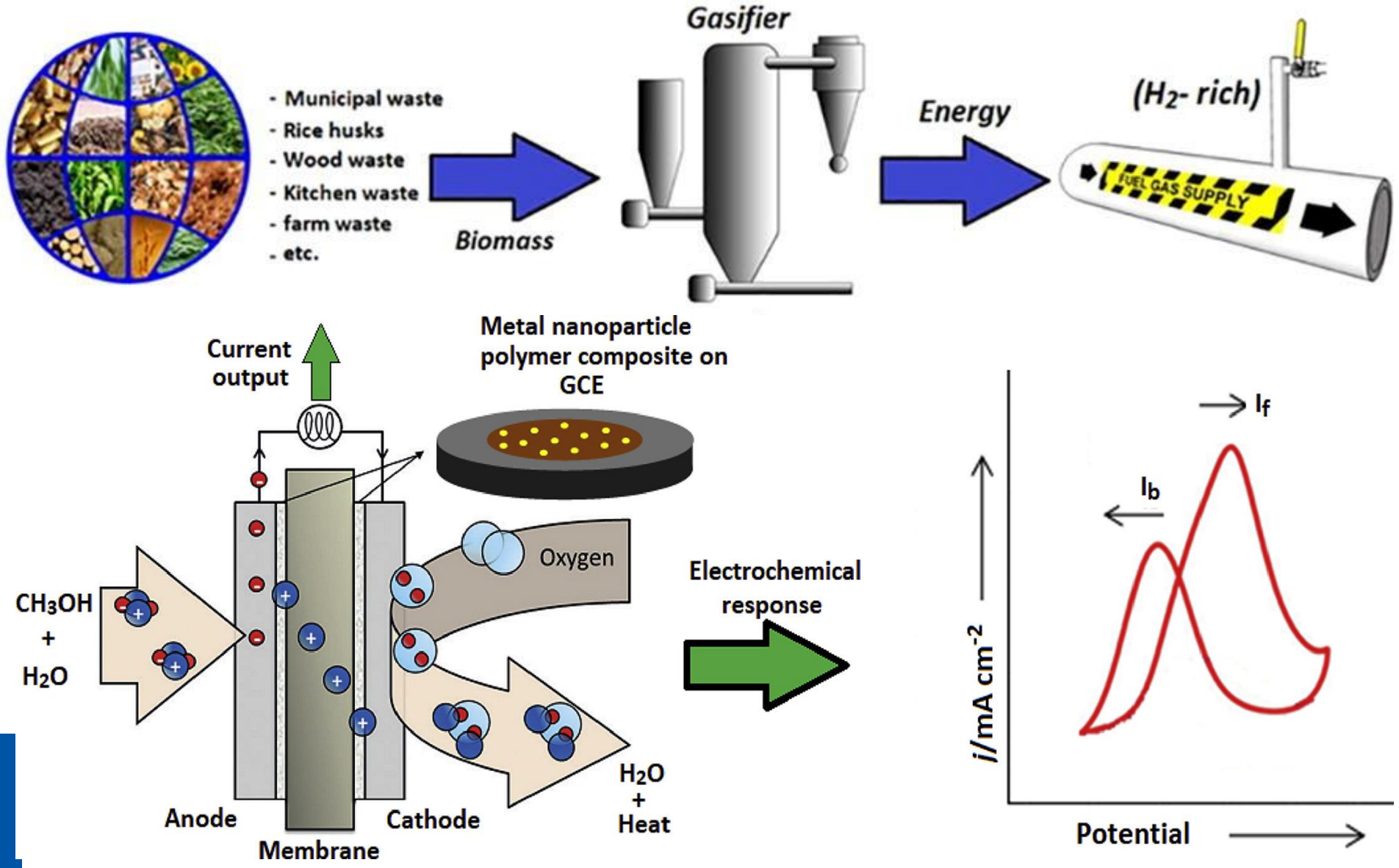









[Sugar hydrolyzate + Nanomaterials stabilized enzyme +Microorganism]
(d)
Enzymatic hydrolysis in presents of nanomaterials
(c)
Nanomaterial treated Thermal & pH stable enzyme
(b)
Improved enzyme production in presents of nanomaterials
(a)
Nanomaterial assisted pretreatment of biomass
(e)
Fermentation
Bioreactor
Enzymes bound to nanomaterial
Enhance biohydrogen Production
Nanomaterials separation & feasibility to reuse
Nanoparticles
Enzyme


- Municipal waste
- Rice husks
- Wood waste
- Kitchen waste
- farm waste
- etc.
Biomass
Gasifier
Energy
(H2- rich)
FUEL GAS SUPPLY
Current output
Metal nanoparticle polymer composite on GCE
CH3OH + H2O
Oxygen
Anode
Membrane
Cathode
H2O + Heat
Electrochemical response
If
Ib
i/mA cm-2
Potential