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DEPARTMENT OF CHEMICAL ENGINEERING

GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING (AUTONOMOUS)

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Dr G.D YADAV

Introduction

Professor G.D. Yadav is one of the topmost, highly prolific, and accomplished engineering scientists in India. He is internationally recognized by many prestigious and rare awards as an academician, researcher, and innovator, including his seminal contributions to education, research, and innovation in Green Chemistry and Engineering, Catalysis, Chemical Engineering, Energy Engineering, Biotechnology and many more. His research productivity is phenomenal with the supervision of 101 Doctoral and 122 Masters Theses; which is the first record in ICT and for any Engineering Professor in India. He was conferred Padma Shri, the fourth highest civilian honour, by the President of India in 2016 for his outstanding contributions to Science and Engineering. He is conferred honorary doctorates by two universities: D.Sc. (Hon. Causa) by DYPU, Kolhapur) and D. Eng. (Hon. Causa) NIT-Agartala.

Achievements

- He is a prolific and innovative researcher who has made extensive original contributions to catalysis-science and engineering, green chemistry and technology, nanomaterials and nanocatalysis, energy engineering, and biotechnology.

- He initiated work on novel techniques of enhanced oil recovery, flow visualization in 2-D and 3-D micromodels, phase transfer catalysis and heterogeneous catalysis.

- He propounded selectivity engineering principles and developed novel concepts in phase transfer catalysis and new solid superacid acids called UDCaTs, ICaTs and MUICaTs.

- He provided the first ever interpretation of the celebrated phenomenon of inversion rate and selectivity in Friedel-Crafts reactions and one of his papers on sulfated zirconia is a citation classic with 654 citations.

- His work on sulfated zirconia, heteropoly acids, clays and ion-exchange resins is well recognized and very well cited with 9 original articles having more than 100 citations.

SANITIZERS

DEFINITION

According to the World Health Organization (WHO), "an alcohol-containing preparation (liquid, gel, or foam) designed for application to the hands to inactivate microorganisms or temporarily suppress their growth. Such preparations may contain one or more types of alcohol, other active ingredients with excipients, and humectants.

TYPES

- **Hand sanitizers can be classified as alcohol-based or alcohol-free.**
- **Alcohol-based sanitizers comprise between 60 and 95 percent alcohol in the form of ethanol, isopropanol, or n-propanol.**
- **Alcohol have tendency to disseminate proteins and counteract certain micro-organisms at this concentration.**

USAGE

- When you do not have access to soap and water.
- When hands are not soiled or greasy.
- When in direct contact with patients, sanitize hands.
- Before wearing sterile gloves, sanitize hands.
- When taking a pulse or blood pressure, and lifting a patient, sanitize hands.
- When there is a direct contact with body fluids or excretions, mucous membranes, non-intact skin, and wound dressings, if hands are not visibly soiled, sanitize hands.
- After contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient, sanitize hands.
- After removing gloves, sanitize hands.

BENEFITS

- The advantages of hand sanitizers are that it is more convenient, portable, easy to use and not time consuming.
- Hand sanitizers which are commercially available contain ingredients which help in preventing dryness of skin.

DEMERITS

- For the efficacy or proper effectiveness of the sanitizer, it should be used on hands, which are free from soil, dirt, blood, or lubrication.
- One must have to take
- care while handling this sanitizer keep it away from fire as it is an alcohol
- contented liquid it catches the fire easily.

PLATINUM AS A CATALYST

which is better than mercury for the production of PVC

Platinum

Mercury

PVC

Producing Polyvinyl chloride is a common industrial process done all over world. 50 million tonnes of PVC is produced every year where mercury is a much needed catalyst.

WHY MERCURY SHOULD'NT BE USED ?

More than half of mercury produced is put onto producing PVC as a catalyst and 40 tonnes of it is evaporated into the atmosphere and polluting the air. We are in need of a better catalyst than mercury which causes no much harm to atmosphere.

A single-atom platinum catalyst could replace the highly toxic mercury one used to synthesize the ingredient to produce PVC. The new platinum catalyst is twice as efficient as the one used by industry, could cut mercury pollution and should be suitable for scaling-up

Platinum on other side showed no much by products or poisoning and polymerization which was due to a better tailored carbon support to platinum. Gold atoms agglomerate and deactivate and also use aqua- regia which is not environment friendly.

PLATINUM OVER OTHER METALS

While trying to use gold and ruthenium on activated carbon as a catalyst, platinum showed better results. The problem with metal catalyst is they from deactivation, mainly due to the reduction of the active metal sites and due to sintering and fouling.

FUTURE OF PLATINUM IN PVC PRODUCTION

Platinum is currently 40% cheaper than gold, production rates will increase and no harm will be caused to the environment.

Fabrication of air filters

THE DEFINITION

Air pollution is the introduction of chemicals, particulates, or biological materials that cause discomfort, disease, or death to humans, damage other living organisms such as food crops, or damage the environment into the atmosphere. It can have a disastrous effect on all components of the nature, including groundwater, soil, and air.

Additionally, it poses a serious threat to living organisms like acid rain, global warming, the greenhouse effect, and climate changes have an ecological impact on air pollution.

We need to understand the problem and address it properly. A creative problem-solving method and human centered approach is required. Hence, we choose design thinking and innovation method to resolve the problem

THE ANSWER TO THE ISSUE

Air filter is a device composed of fibrous or porous materials which removes solid particles such as dust, pollen, mold and bacteria from the air, Filters containing an adsorbent or catalyst such as charcoal (carbon) may also remove odors and gaseous pollutants such as volatile organic compounds.

MECHANISM

IMPINGEMENT:

In this process, the dust particles with high density are captured. Due to inertia, the dust particles do not follow the air streamlines.
Instead, they move straight ahead to collide with the filter fibers to which they become attached.

INTERCEPTION:

In this process, the particles get attached to the filter surface due to some force of attraction. If the forces of attraction between the fiber and the dust particle are stronger than the tendency of the airflow to dislodge it, the particle will be removed from the air stream.

DIFFUSION:

This effect explains the capture of very small particles. As the air passes through the filter media, minute particles do not precisely follow the streamlines. Instead, they are bombarded by air molecules which cause them to take an erratic path described as Brownian movement. This erratic path increases the probability that particles will come in contact with fibers and will stay attached to them.

MATERIALS USED

OUTER FRAME:

It is usually made up of thermosetting plastics to provide mechanical support and strength.

COCONUT HUSK:

It is a natural fibre filtering media that biologically treats pollutants and acts as a barrier to retain solids. It helps removing visible dust.

SOY FILTER:

This filter is made up purified soy protein which filters particulate matter similar to other air purifiers.

BAMBOO CHARCOAL OR ACTIVATED CARBON:

It is made by burning bamboo at different temp. Ranging from 800 to 1200 degrees Celsius. As it shows excellent adsorption properties, majority of the filtration takes place by this filter.

FAN ASSEMBLY WITH PLUG:

These are open type fans which are directly fitted un the filter body. Usually made up of aluminum or stainless steel.

PRE- COATING THE FILTER:

A filter cake is formed by the substances that are retained on a filter. Filter aids, such as perlite or activated carbon are usually used to form the filter cake. The filter cake grows in the course of filtration, becoming "thicker" as particulate matter and filter aid is retained on the filter. The purpose is to increase flow rate or achieve a smaller micron filtration.

WORKING

Firstly, impure or outdoor air is pulled towards the center of the fan assembly, and then exhausted across the entire surface area. The outdoor air will be made to pass through the filter using this fan. Coconut husk is the first filter and the particles ranging from 75 to 300 micrometers which is visible.

CONCLUSION

Even though there are various types of air filters like COWAY and HONEYWELL air purifiers. But using an better type of input will also play an important role in thriving to reduce air pollution and our filter uses biodegradable and not so expensive materials which helps to reduce cost and also in saving our environment

ANAEROBIC DIGESTION FOR AGRO AND FOOD WASTE

Organic wastes are primarily agro & food and also slaughtering waste.Biogas is a mixture of different compounds, i.e., primarily methane (CH_4) and carbon dioxide (CO_2) and small amounts of water vapor (H_2O), hydrogen sulfide (H_2S), hydrogen (H_2), and siloxanes. Biogas is produced during anaerobic digestion (AD) of organic materials, carried out by a complex microbial community through multiple complicated biochemical reactions.

Food wastes contain high amounts of moisture, volatile solids, and salinity; etc and it is main source of GHG emissions, unpleasant odors, The food wastes from retailers are often disposed of as municipal solid waste (MSW) which contributes about 20 to 54%.The recycling rate of food wastes lower than industrial wastes due to the lower quality and the existing impurities. Sorting of the MSW for Anaerobic Digestion is as important.

Biochemical Reaction

The degradable fraction of food wastes mainly includes carbohydrates ($C_6H_{12}O_6$),proteins ($C_{13}H_{25}O_7N_3S$), and lipids ($C_{12}H_{24}O_6$). Slaughtering wastes are fats and proteins and complex compounds.

FOUR STAGES IN AD

Hydrolysis:

Hydrolyzing bacteria excrete exo-enzymes, such as amylase, cellulase, xylanase, lipase, and protease. The hydrolytic enzymes are adsorbed onto the substrate surface leading to the gradual conversion of polymers into monomers and oligomers (e.g., glucose, fatty acids, glycerol, and amino acids), which are soluble in water. Hydrolysis stage is typically the rate-limiting step.

Acidogenesis:

The released monomers and oligomers are then degraded to short-chain fatty acids, alcohols, and gaseous byproducts (NH_3, H_2, CO_2, and H_2S) through the acidogenesis stage. *The undesirable oxygen can be consumed by facultative anaerobic microorganisms in the first two stages*

Acetogenesis:

At the third stage, the organic materials produced in the previous stage are converted into acetic acid, hydrogen, and CO_2.

Methanogenesis:

Methanogens produce methane from either CO_2, methyl, or acetate under strictly anaerobic conditions. Methanogenesis is the rate-limiting stage in the AD of easily degradable feedstocks of low buffering capacity. In this way we can have a better way for discarding our food and agro waste. Even though there are various technical or social barriers; we need to break out these barriers to give a better earth for the future.

CARBON DIOXIDE TO JET FUEL

Today, airplanes pump a lot of climate-warming carbon dioxide into the atmosphere. But someday, carbon dioxide sucked from the atmosphere could be used to power airplanes.

A new iron-based catalyst converts carbon dioxide into jet fuel, researchers report online December 22 in Nature Communications. Unlike cars, planes can't carry batteries big enough to run on electricity from wind or solar power. But if CO2, rather than oil, were used to make jet fuel, that could reduce the air travel industry's carbon footprint — which currently makes up 12 percent of all transportation-related CO2 emissions.

Past attempts to convert carbon dioxide into fuel have relied on catalysts made of relatively expensive materials, like cobalt, and required multiple chemical processing steps. The new catalyst powder is made of inexpensive ingredients, including iron, and transforms CO2 in a single step.

When placed in a reaction chamber with carbon dioxide and hydrogen gas, the catalyst helps carbon from the CO2 molecules separate from oxygen and link up with hydrogen — forming the hydrocarbon molecules that make up jet fuel. The leftover oxygen atoms from the CO2 join up with other hydrogen atoms to form water.

Tiancun Xiao, a chemist at the University of Oxford, and colleagues tested their new catalyst on carbon dioxide in a small reaction chamber set to 300˚ Celsius and pressurized to about 10 times the air pressure at sea level. Over 20 hours, the catalyst converted 38 percent of the carbon dioxide in the chamber into new chemical products. About 48 percent of those products were jet fuel hydrocarbons. Other by-products included similar petrochemicals, such as ethylene and propylene, which can be used to make plastics.

INDUSTRIAL GAS LEAKS

Many factories and industries use different kinds of gases in their production, in that several gases are harmful for nature and humans.

When those gases leak, people living nearby inhale the gases and will face several problems such as headache, fatigue, weakness and depression, Hearing loss, Pulmonary edema, Irritating and corrosive to the eyes, Respiratory problems, or they might even face death.

There occurred a gas leak from a chemical plant in Visakhapatnam in which at least 11 people were killed and 1,000 members were affected.

The Bhopal gas tragedy in which more than 3,000 people were killed when Methyl Isocyanate leaked is still recorded as the world's most disastrous industrial gas leak.

REASON BEHIND THE GAS LEAK:

1.As we all know that the gases are stored in tanks and those gases exert some pressure on the walls of the tanks.But to reduce the pressure exerted by the gas in the tank it is cooled at an appropriate temperature by using a cooling system.

2.Whenever there is a damage to this cooling system thenthe temperature of the gas increases inside the tank and as the pressure isproportional to the temperature by the ideal gas law PV=nRT then the gas startsto exert the pressure due to which the tank gets damaged and the gas will leakout and also sometimes it may leads to a blast.

3.The Vizag Styrene gas leakage is the recent example for this.

WIRELESS ALARM SYSTEM:

All wireless alarm components use radio frequencies to communicate.

- For wireless alarms the frequency range is between 400
- and 900 MHz, because at these lower frequencies, wireless signals are much better able to penetrate through solid building materials and furnishings.
- There will be a radio frequency emitter at the factory and a receiver at the house through which both the alarms are connected.
- Whenever a gas detector detects the gas then we on the alarm in the factory and similarly the alarm in the house will on and people will know about it so that they can evacuate that place quickly to save their lives.

FUNCTION OF THE DEVICE :

PCE-GA 10 is a gas leak detector which not only detects the gas leak but also gives the intensity of the leaked gas. If we connect it to a control panel then with the help of the control panel we will control the alarm. After the gas detector detects the gas it will send the amount of gas released in ppm on to the screen of the control panel. If we are able to control the gas leak within the factory then no need to on the alarm, if it is uncontrollable then we will on the alarm. Apart from that we will keep a record of the ppm limit for the gas used in the factory because, there may be a case where it is impossible to on the alarm manually then in that case based on the ppm limit the alarm will on automatically like we mentioned in the above points.

SHUFFLE- IT

1. ANTCBUSES - _____
2. OILNTMFOCIRTAINSES - _____
3. YSRDER - _____
4. CTUIEPMAN OSREOVCYN - _____
5. UATINAOSTR- _____
6. EGUPR- _____
7. DYLSERON MREBUN - _____
8. IKSN RIONTFCI - _____
9. OSRCOSPMSERS - _____
10. EBUMA LESAC - _____

Quiz

1. what is the actual power required to drive a reciprocating air compressor which has to compress 34m^3 of air per minute from 1.013x105 N/m^2 to 4.052x105 N/m^2? assume that PV1.25 is constant Where, P is pressure V is volume, and efficiency of the compressor is 85%

(a)107.9kW (b)200 kW (c)82.6 kW (d)91.7 kW

2. a butane isomerization process produces 70 Kmol/h of pure isobutane. Purge stream removed continuously contain 85% n-butane containing 15% of impurity (mol%). The feed stream is n-butane containing 1% (mol%). The flow rate of purge stream will be

(a)3 Kmol/h (b)4 Kmol/h (c)5 Kmol/h (d)6Kmol/h

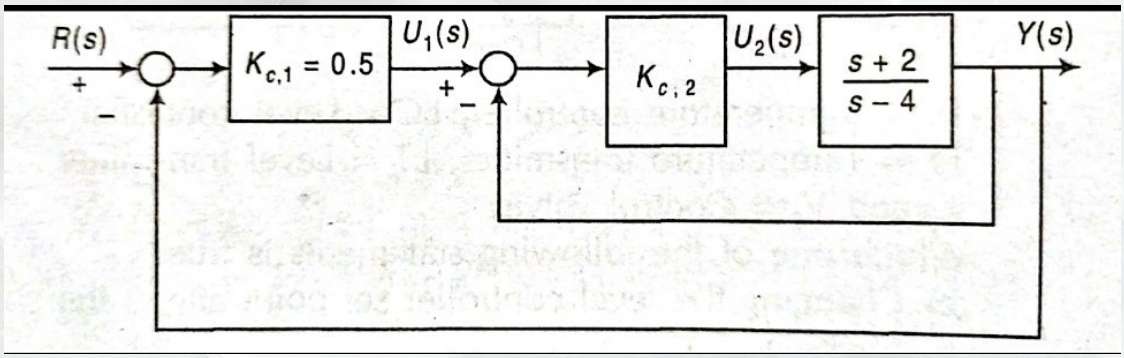
3. A metal ball of radius 0.1m at a uniform temperature of 90 ℃ is left in air at 30 ℃. The density and the specific heat of the metal are 3000 kg/m3 and 0.4kJ/kg-k respectively the heat transfer co efficient is 50W/m2-K .Neglecting the temperature gradient inside the ball, the time taken (in hour)For the ball to cool to 60 ℃ is

(a)555 (b)55.5 (c)0.55 (d)0.15

4.a packed bed reactor converts A to R by first order reaction with 9mm pellets in strong pore diffusion regime to 6.2% level. If 18mm pellets are used what is the conversion

(a)0.39 (b)0.61 (c)0.632 (d)0.865

5.Consider a cascade control configuration as shown in figure below



The system is stable when Kc,2 is

(a)3/4 (b)1 (c)5/4 (d)3/2

6. a reactor needs to be lined with corrosion resistant lining. One type of lining costs Rs.5 lakh , and is expected to last for 2yr. another type of lining lasts for 3 yr. if both choices have to be equally economical with effective interest rate being 18%, compounded annually the price one should pay for second type of lining is

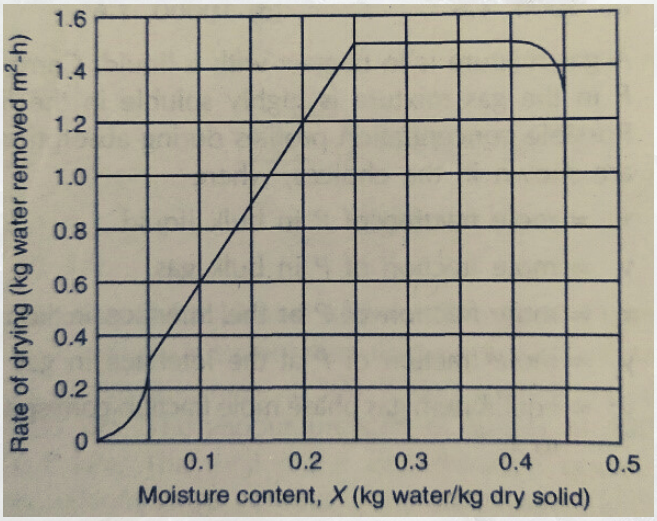
(a)Rs6.1 lakhs (b)Rs.6.5 lakhs
(c)Rs.6.9 lakhs (d)Rs.7.6 lakhs

7.acetone is to be removed from air in an isothermal dilute absorber using pure water as solvent the incoming air contains 5 mol% of acetone (yin =0.05) the design equation to be used for obtaining the number of trays (N) of the absorber is N+2=6log(yin/yout) for 98% recovery of acetone, the number of trays required is/are

(a)1 (b)8 (c)9 (d)10

8.A batch of 120kg wet solid has initial moisture content of 0.kg water/kg dry solid. The exposed area for exposed area for drying is 0.05m2/kg dry solid. The rate of drying follows the curve given below

The time required (in hour) for drying this batch to a moisture content of 0.1kg water/kg dry solid is



(a)0.033 (b)0.43

(c)0.6 (d)2.31

9.The energy required per unit mass to grind lime stone particles of very large size to 100μm is 12.7kWh/ton an estimate (using bond's law) of the energy to grind the particles from a very large size to 50μm is

(a) 6.25kWh/ton (b) 9.0kWh/ton

(c) 18kWh/ton (d) 25.4kWh/ton

Brewing....

Ozone 5.0