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Editorial

Polymers are a very essential class of materials without which the life would become very difficult. It has wide application in everyday use for example rubber, plastic, resins, and many more. Polymers have high molecular weight, known as macromolecules. Many polymers can be derived from natural origin. The present issue focus on the biomedical application of polymers .

An industrial effluent is major water pollutant and effect the diversity of aquatic biota and water quality. So cost-effective and efficient effluent treatment technology have been to be developed. The main objective of the study was to evaluate the performance of a laboratory scale biological treatment unit for dairy industrial effluent and determination of the kinetic parameters like Ks, Kd, k and Y for activated sludge process. Findings of present studies which were in the range of other industrial wastewaters treatment processes.

The issue also emphasis on the use of static electromagnetic field as a pre-sowing treatment was found to enhance growth of Wheat and Brinjal plant in early stage of growth.

Here by all the students and faculty members are invited to read and contribute to ''QUEST'' to propagate the idea of knowledge gaining by sharing.

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NEWS AND VIEWS:-

REVIEW ARTICLE:-

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Research News: About 400 words (1 page)
Research Article: About 2000 words (4 pages)

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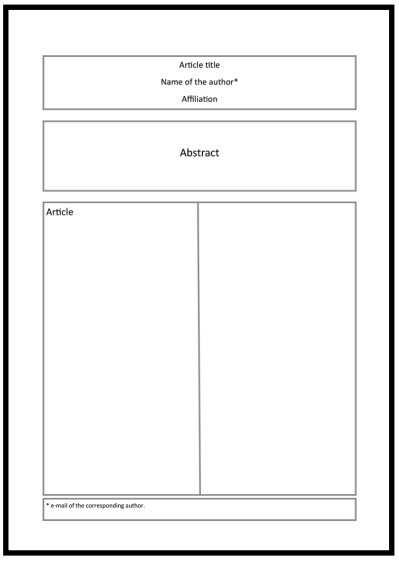

Time-trail off shows how anticancer and antiviral drugs get into cells

Recent time's nucleoside analogs can use as one of the most effective treatments against viral infections and cancer. These are essentially faulty versions of molecular building blocks that can slip into cells and get incorporated into DNA, effectively throwing a wrench into the machinery that viruses and cancer cells to make copies of themselves.

Such compounds, which include chemotherapeutic agents like 5-fluorouracil and gemcitabine, popular HIV drugs like AZT, and potent hepatitis B treatments like acyclovir, have dramatically changed the outcomes for millions of people afflicted with life-threatening illnesses.

Duke University scientists have now modeled the complex shape and movement of biomolecules to make an animation depicting how nucleoside analogs and natural nucleosides are transported into cells. The heart of the system is a specific molecule aptly named the concentrative nucleoside transporter, or CNT. The scientists' movie shows CNT slowly moving its cargo like an elevator, stopping at various points across the cell membrane before reaching the other side.

Their early research, provide important structural information that could be used to design smarter, more specific anticancer and antiviral drugs. Their study is the first to provide a visualization of almost every possible conformation of this transporter in motion. By understanding how this transporter recognizes and imports nucleosides, they may be able to redesign drugs that are better at getting inside specific cells like those harboring cancer or a virus.

The blueprint for every living organism lies in the twisted strands of DNA buried within cells. These strands are composed of four nucleotide "bases" -- G, A, C, T, arranged along a backbone of sugars and phosphate molecules. Every time a cell grows and divides, it has to make more copies of those original strands of DNA. Hence, active cells are constantly importing more building blocks to replenish their genetic material, especially the essential nucleosides, which are like a nucleotide base without a phosphate attached.

Fifty years ago, scientists designed the first nucleoside analogs, molecular mimics that muck up this DNA construction supply chain in order to incapacitate rapidly growing and particularly needy cancer cells and viruses.

Like their natural counterparts, nucleoside analogues are carried across the cell membrane by special proteins called nucleoside transporters. In this study, Lee's group sought to capture one of the most common transporters, known as the concentrative nucleoside transporter or CNT, as it traversed the membrane.

Marscha Hirschi, a graduate student in Lee's lab, used a technique called x-ray crystallography to create an atomic-level three-dimensional picture of the protein. She then took a series pictures of CNT in different conformations to produce a kind of time-lapse video of the transporter in action: first, as it is ready to capture the nucleoside uridine on the surface of the cell; next, as it moved

across the membrane in stages; and finally, as it released the uridine inside the cell.

They found that there is a region on the protein called the transport domain that acts like an elevator, shifting into different conformations as it transports cargo up and down across the membrane. Other studies had shown that many transporters move in this way, but ours is the first to record nearly all of the stages of the elevator model. This more detailed understanding could provide a platform to the future development of drugs that are more selective and efficient.

Lee says that transporters responsible for importing a variety of different molecules, such as neurotransmitters, metabolites, and ions, use mechanisms similar to CNT. Thus, the new findings could have implications that reach beyond viral infections and cancer to a number of different clinically relevant physiological processes.

-Contributed by Sandeep Chovatiya
ARIBAS

Young eels use magnetic 'sixth sense' to navigate

The Gulf Stream fast-tracks young European eels from their birthplace in the Sargasso Sea to the European rivers where they grow up. Eels can sense changes in Earth's magnetic field to find those highways in a featureless expanse of ocean — even if it means swimming away from their ultimate destination at first, researchers report in the April 13 *Current Biology.*

European eels (*Anguilla anguilla)* mate and lay eggs in the salty waters of the Sargasso Sea, a seaweed-rich region in the North Atlantic Ocean. But the fish spend most of their adult lives living in freshwater rivers and estuaries in Europe and North Africa.

Exactly how eels make their journey from seawater to freshwater has baffled scientists for more than a century, says Nathan Putman, a biologist with the National Oceanic and Atmospheric Administration in Miami.

The critters are hard to track. "They're elusive," they migrate at night and at depth. The only reason we know they spawn in the Sargasso Sea is because that's where the smallest larvae have been collected. Some other marine animals, like sea turtles and salmon, tune in to subtle changes in Earth's magnetic field to help them migrate long distances. To test whether eels might have the same ability, Putman and his colleagues placed young European eels in a 3,000-liter tank of saltwater surrounded by copper wires. Running electric current through the wires simulated the magnetic field experienced at different places on Earth.

With no electric current, the eels didn't swim in any particular direction. But when the magnetic field matched what eels would experience in the Sargasso Sea, the fish mostly swam to the southwest corner of their tank. That suggests the eels might use the magnetic field as a guide to help them move in a specific direction to leave their spawning grounds.

Swimming southwest from the Sargasso Sea seems counterintuitive for an eel trying to ultimately go northeast, Putman says. But computer simulations revealed that that particular bearing would push eels into the Gulf Stream, whisking them off to Europe. Catching a more circuitous ride on a current is probably more efficient for the eels than swimming directly across the North Atlantic, says Putman.

Magnetic fields could help eels stay the course, too. A magnetic field corresponding to a spot in the North Atlantic further along the eels' route to Europe sent the eels in the tank heading northeast. That's the direction they'd need to go to keep following the Gulf Stream to Europe.

The Gulf Stream is such a powerful current that the eels could wriggle in a spread of directions to get swept up in its flow. Now, the researchers are looking at whether adult eels use a similar magnetic map to get back to the Sargasso Sea. Adults follow a meandering return route that might take more than a year to complete, previous research suggests. But whether there's some underlying force that guides them remains to be seen.

-Contributed by Sandeep Chovatiya
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POLYMERS IN PHARMACEUTICALS

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Abstract: Now a days the use of polymers are increasing exponentially. The various sources of polymers are exploited and successfully used in various drug delivery system not limiting to it but also in the packaging of the sophisticated drugs. The polymers supports in the controlled drug delivery efficiently.

Introduction

Polymers are a very essential class of materials without which the life would become very difficult. It has wide application in everyday use for example rubber, plastic, resins, and many more. The word polymer includes two words of Greek origin, poly= many and mers= parts or units of high molecular mass each molecule of which comprises of a huge number of single structural units joined together in a regular fashion. Specifically polymers are bigger molecules of high molecular weight, known as macromolecules, which are polymerizes by linking together of a large number of small repeating molecules, called monomers. Many polymers can be derived from natural origin e.g. mineral, botanic or biologic. Some of them have been used for a period of time. In the botanical kingdom, cellulose is the most abundant macromolecule[1-2].

A class of polysaccharide i.e. cellulose is a composed of repeating units of cellobiose which is a dimer of glucose. In the biologics, chitin which is derived from the sea source, is a polymer of N- acetyl glucosamine. It is generally dispersed as the main component of the shell of arthropods. Proteins and nucleic acids are well known as life supports, and these natural polymers are also retained[3-4].

The wide use of such polymers are including the biomedical and pharmaceutical fields[[5].

Definition

"**Polymers are long chain organic molecules assembled from many smaller molecules are recognized as monomers**."

In pharmaceutical preparations polymers have several applications in manufacturing of bottles, syringes, vials, catheters, and also in drug formulations[6].

In pharmaceutical application the polymers are broadly classified as:

A. Based on origin: this may be further classified as:

a) Natural Polymers: e.g. Proteins – Collagen, Keratin, Albumin Carbohydrates – starch, cellulose, glycogen.

b) Synthetic Polymers: e.g. polyesters, polyanhydrides, polyamides.

B. Based on Bio-stability:

a) Bio-degradable Polymers: e.g. polyesters, proteins, carbohydrates, etc

b) Non – biodegradable Polymers: e.g. ethyl cellulose, HPMC, acrylic polymer

Applications of polymers:[7]

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It should possess good mechanical strength and more over it could be administered easily.

Applications in conventional dosage forms

There are several Solid Dosage Forms which widely used for drug delivery includes Tablets, Capsules, Gels and Transdermal Drug Delivery Systems (Patches).

Tablets

Binder and Disintegrants are commonly used polymer ingredients in the tablets which bind the powder particle in a moist mass. For this purpose commonly used polymers are Ethyl cellulose (EC), HPMC, Starch, Gelatin, polyvenylpyrrolidine. Alginic acid, Glucose, Sucrose etc. Disintegrante's role is to decrese the dissolution time and act fastly. The polymers used for this purpose are Starch, cellulose, Alginates, polyvenylpyrrolidine, sodium CMC.

Capsules

The flexibility and strength of the Gelatin are depend on the plasticizer used and it is also help in control of the release rate.

Disperse Systems

The biphasic system alike emulsion, suspensions use several polymer for disperse one phase into another phase i.e. water phase disperse in oil phase or vice versa the polymer like poly vinyl pyrolidine, ethyl cellulose etc. Dispersed Systems comprise of particulate stuff known as the dispersed phase, disseminatedall through the dispersion medium with the aid of dispersing agent polymer mentioned above. In the oil in water in oil type emulsion the dispersion of drug content is very difficult but it is easily produced by using polymer as a dispersing agent.

Film Coatings[8]:

The ability of Chitosan to form stable film offers as a good coating agent for conventional solid dosage forms such as tablets. Moreover it is useful for solid dosage forms, such as granules, micro particles formation. Microcrystalline chitosan are also used as gelforming excipients for matrix-type drug granules. For controlled drug release system the combination of positively charged chitosan with negatively charged biomolecules, such as gelatin, alginic acid, and hyalouronic acid reported to be a novel matrices with distinctive characteristics.

Polymers in biomedical applications[10]

Water-Soluble Synthetic Polymers:

This class of polymers are widely used as coagulants, flocculent e.g. ethylene oxide. It is also used as swelling agent. Poly ethylene glycol is often used as plasticizer while polyvinyl alcohol is used inwater-soluble packaging, tablet binder and tablet coating. Polyacrylamide provides a medium for Gel electrophoresis in which proteins are separated based on their molecular weights.

Cellulose-Based Polymers

Ethyl cellulose is Insoluble in water but dispersible so it is used as coating system for sustained release applications while Carboxymethyl cellulose has application assuperdisintegrant and emulsion stabilizer.

For tablet coating hydroxyethyl and hydroxypropyl celluloses are widely used.

Hydroxypropyl methyl cellulose replaces gelatin as a capsule material and often used asbinder for tablet matrix and tablet coating.

Starch-Based Polymers has several application for tablet and capsule, it is used as Glidant, diluent, a disintegrant, a tablet binder Sodium starch glycolate,superdisintegrant for tablets and capsules in oral delivery.

Plastics and Rubbers[11-12]:

Septum for injection, plungers for syringes, and valve components are produced by Polychloroprenewhile polyurethane is used as transdermal patch backing (soft, comfortable, moderate moisture transmission), blood pump, artificial heart, and vascular grafts. Poly vinyl acetate employed asa binder for chewing gum. Polypropylene applied as tight packaging materials, heat shrinkable films and containers. Blood bag and tubing's are prepared by Poly vinyl chloride.Hard contact Lenses are prepared by poly methyl methacrylate while Soft contact lenses are by poly hydroxyethyl methacrylate.

Polymers used in parenteral drug delivery system:

Usually, Biodegradable polymers are preferred for the preparation of parenteral drug delivery system as it get sullied in the body and doesnot necessitateelimination from the body.

Verity of biodegradable polymersare available in naturally occurring to synthetically prepared e.g. naturally available albumin starch, dextran, gelatin, fibrinogen, hemoglobin are widely used while cynoacrylates, poly butyl - 6 -6, poly acryl amides, poly ethyl--poly (alkyl cynoacrylates, poly amides. Nylon 6-10 nylon-cynoacrylates, poly amino acid, poly urethane. Aliphatic poly esters are poly (lactic acid) poly lactide - co glycolide) poly glycolic acid, poly caprolactone, polydihydroxy butyrate, poly hydroxy butyrate co-valently cross linked protein, hydrogel are the synthetically available polymers which are having required characteristic for parenteral drug carrier

Following are the required characteristics of an ideal parenteral drug carrier[13-14]:

1. Versatility
2. High capacity to carry a sufficient quantity of drug.
3. Limiting drug distribution to the anticipated target tissue.
4. Uniform distribution capacity
5. Controlling drug activity at the target site over anextended period.
6. Protecting drug from inactivation by plasma enzymes.
7. Biocompatible and minimally antigenic.
8. Easily undergo in biologic degradation with quick elimination and nominal toxicmetabolized products.

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Treatment kinetic coefficients studies of effluent treatment plant of dairy industry and laboratory batch reactor

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Abstract: As Dairy industries consume large volume of water are considered as "wet industries". Dairy industries discharging untreated/partially treated wastewater cause serious environmental problems. Milk-Processing industrial wastewater is generally treated using secondary (biological) methods such as up-flow anaerobic sludge blanket reactor (UASB), activated sludge process, trickling filter, sequencing batch reactor (SBR) and anaerobic filters etc. For the rational design of effluent treatment facilities the determination of the treatment kinetic coefficients are necessary. The objective of the research was to evaluate the performance of a laboratory scale biological treatment unit for dairy industrial effluent and determination of the kinetic parameters like K_s, K_d, k and Y for activated sludge process. K_s is the half velocity constant and numerically equal to the substrate concentration. It is the maximum value at saturation concentration of growth limiting substrate. K_d is the microbial decay coefficient and represents the biomass lost to endogenous respiration per unit of biomass per unit time. k is the maximum rate of substrate utilization per unit mass of microorganisms. Y represents the biomass yield, *i.e.*, how biomass is produced against substrate utilized. The kinetic coefficients for laboratory batch scale process for dairy effluent treatment *i.e.* k (maximum substrate utilization rate), K_s (half velocity constant), Y (cell yield coefficient), and K_d (decay coefficient) were found to be 4.43 g bsCOD/g VSS day^{-1}, 535 mg/l BOD, 0.28 mg VSS/mg BOD and 0.038 g VSS/g VSS day^{-1}, respectively. These coefficients may be used for the design of activated sludge process facilities for dairy wastewater.

Introduction

Water pollution is define as any type of physical, chemical or biological change in water quality which leads to detrimental impacts on living organisms in the environment. The quality of life depends on the availability and quality of water. Water is vital to all forms of life, all plants, animals and humans. In all fields like agriculture, manufacturing, transportation and many other human activities and despite its importance, water is the most poorly managed resource in the world. An industrial effluent discharge is responsible for presence of heavy metals in streams of water and reflects the type and diversity of aquatic biota, water quality and pollution[1]. Most of the industries in India are placed along the river banks for easy availability of water and disposal of the waste. Main pollutants present in waste water are biodegradable and volatile organics, recalcitrant xenobiotics, toxic metals, suspended solids, nutrients (Nitrogen & Phosphorus), microbial pathogens and parasites [2].

The degradation of various ecosystems on which human life relies on occurs due to continued population growth and industrialization from the last century. Pollution is primarily caused by the discharge of inadequately treated industrial and municipal wastewater.

The dairy waste consists of raw materials lost during handling and processing and materials carried into processing water. The composition involves a substantial concentration of lactose, lactic acid, minerals, detergents and sanitizers. The majority of the pollutants are dissolved in either organic or inorganic form.

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The unavoidable waste generation process include rinsing, cleaning and sanitizing of pipelines and equipment start up, losses during the filling operations spill over of lubricants from pipelines, joints, valves, and pumps etc [3].

Wastewater from dairies contains mainly organic and biodegradable materials that can disrupt aquatic and terrestrial ecosystems [4]. Sediment in dairy effluent can change the color, clarity, temperature of water ways, reduce light penetration and can clog up fish gills. The organic material responsible for excessive growth of bacterial and fungal slimes and the inorganic nutrients can increase algal blooms result into eutrophication. Effluent may contaminant groundwater and penetrates the surface soil layer, deterioration in soil structure and weed growth [5]. So a cost-effective and efficient effluent treatment technology has to be developed. The main objective of this study was the determination of kinetic parameters *Y, K_d, k* and K_s and the treatment efficiency evaluation of dairy effluent treatment plant with and laboratory designed batch aeration treatment process.

Materials and Methods:

Effluent samples for kinetic coefficient calculation and laboratory scale reactor were collected from a local dairy. The dairy effluent treatment process has primary treatment plant comprising of equalization tank and secondary treatment plant comprising of anaerobic reactor (UASB) followed by aeration tank and settling tank. The total detention times in equalization tank, anaerobic and aerobic process at maximum wastewater flow of 600-650$m^3.d^{-1}$ were 4-5 days.

Sample collection and analysis of wastewater samples

The reliability of the results of analysis of waste water samples depends upon the proper collection of sample. The sample after collection should be transported to the laboratory in well conserved condition so that it will still represent fairly, accurately to the waste in its original state. Sample has been collected for the plant operation controls. The samples collected from the various units should be transported to laboratory as early as possible. The analysis of the samples should be taken up within the shortest time gap between collection and testing. The analysis which is carried out for different samples should broadly consider the following major parameters: COD, BOD, TS, TSS, TDS, MLSS and MLVSS (X)[6].

Samples from the inlet of the reactor and effluent from the final clarifier were simultaneously collected to carry out COD tests. Samples from the reactor were collected to find out MLSS, dissolved oxygen (DO), pH and temperature. Mean values of S_0, S and X at various ϑ_c were used to find out kinetic coefficients while DO, pH and temperature tests were carried out to ensure favorable environmental conditions in the reactor for biological treatment [7,8].

Dairy effluent treatment kinetic coefficients study at laboratory scale

Laboratory batch scale processes are normally used to determine kinetic coefficients. Completely mixed batch reactor without recycle was employed for its easy operational control. In such a reactor, detention time (θ) is equals to mean cell residence time (ϑ_c). The procedure was to operate the unit over a range of effluent substrate concentrations. Hence, several different ϑ_c (at least five) were selected

for operation ranging from 4 to 10 days. Using the data collected at steady state conditions, mean values were determined for influent COD (S_o), effluent COD (S), and mixed liquor suspended solids (MLSS) of the batch rector (denoted by X) to find out the kinetic coefficients.

Determination of kinetic coefficients

Design of biological treatment systems should be based on the kinetic approach. Knowledge of the kinetics and determination of the kinetic coefficients for a particular wastewater are, therefore, imperative for the rational design of treatment facilities. Samples from the influent to the reactor and effluent from the final clarifier were simultaneously collected to carry out BOD tests. Samples from the reactor were collected to find out MLSS, dissolved oxygen (DO), pH and temperature. Mean values of S_0, S and X at various time interval were used to find out kinetic coefficients while DO, pH and temperature tests were carried out to ensure favorable environmental conditions in the reactor for biological treatment.

The following linearized equation used to find k and K_s.

$$\frac{X\theta c}{S_0 - S} = \frac{Ks}{k}\frac{1}{S} + \frac{1}{k}$$

The following linearized equation used to find Y and K_d.

$$\frac{1}{\theta c} = Y\frac{S_0 - S}{X\theta c} - Kd$$

Where, S_0 = Influent substrate concentration, mg sCOD/L; S = Effluent substrate concentration, mg sCOD/L; X = Biomass concentration, mg MLVSS/L; k = Maximum rate of substrate utilization per unit mass of microorganisms, time^{-1} ; K_d= Endogenous decay coefficient, time^{-1}; K_s = Half velocity constant, substrate concentration at one-half of the maximum growth rate, mass/unit volume; Y= Cell yield coefficient, mg/mg (defined as the ratio of the mass of cells formed to the mass of substrate consumed).

Results and Discussion:

Kinetic coefficient calculation of existing effluent treatment plant of dairy industry

The general characteristic of dairy industrial wastewater is shown in table 1. Kinetic coefficients of interest for the design of activated sludge process are: k, K_s, Y, and K_d where value of k is use to find out the volume of biological reactors. Mean values depicted in table 2 were used to find out kinetic coefficients for dairy effluent treatment plant.

Greater is the value of k, smaller will be the size of the reactor. K_s have no direct relevance in process design (figure 1). It gives an idea about the change in the specific growth rate of bacteria with a change in the concentration of the growth limiting substrate. Y is used to estimate the total amount of sludge produced as a result of wastewater treatment. K_d is used to find out the net quantity of sludge to be handled and hence the size and cost of the sludge handling facilities can be found out figure 2.

A comparison of kinetic coefficients for dairy effluent with other industrial wastewaters would be interesting. However, the results obtained for initial two kinetic coefficient i.e. k (substrate utilization rate) was within the range and half velocity coefficient K_s was less than the standard value noted for the kinetic coefficients of other industrial wastewaters as shows in table 3.

Table 1. Characteristics of dairy industrial wastewater

No.	Characteristics	Value
1.	pH	6.8-7.5
2.	COD	2000-4660 ppm
3.	TS	970-1170 (mg/L)
4.	TSS	282-380 (mg/L)
5.	TDS	670-810 (mg/L)

Table 2. Mean values of dairy effluent treatment kinetic parameters

Θ_c (days)	n [1]	S_o (mg/l)		S (mg/l)		X (mg MLSS/l)	
		Range	Mean[2]	Range	Mean[2]	Range	Mean[2]
3	4	3754-3846	3800±36	114-129	121±6	328-388	358±23
4	4	3602-3678	3640±30	92-104	98±6	290-402	346±44
5	4	3382-3538	3460±52	85-65	75±8	338-386	362±18
7	4	3214-3346	3280±24	68-56	62±5	287-383	335±20
10	4	3396-3284	3382±44	52-44	48±3	287-383	340±37

Decay coefficient K_d was quite less for dairy wastewater when compared with other industrial wastewaters, which indicates larger net sludge volumes resulting from biological treatment. Cell yield coefficient (Y) was quite lower than other industrial wastewaters which would have direct impact on lower half velocity substrate coefficient.

Kinetic coefficient study at laboratory scale for the treatment of dairy effluent

In dairy wastewater treatment all the processes are carried out as continuous operations and wastes originating there of vary considerably in composition. Mean values of selected treatment parameters represent in table 4 were used to obtain kinetic coefficients for laboratory reactor used for dairy industrial wastewater. Therefore ranges of detention time and substrate concentration have been analyzed to optimize the value of treatment kinetic coefficient.

Table 5 clearly shows that values of the bio kinetic coefficients vary significantly with the change in MLSS concentration in each process. The results obtained for initial two kinetic coefficient i.e. k (substrate utilization rate) was within the range and half velocity coefficient K_s was also in the range (4-5) noted for the kinetic coefficients of other industrial wastewaters as shows in table 6.

Decay coefficient K_d was quite less in batch process. Cell yield coefficient (Y) was also comparatively matched with the other industrial treatment values. The values of Y in batch process were increasing with the increase in MLSS concentrations, since they

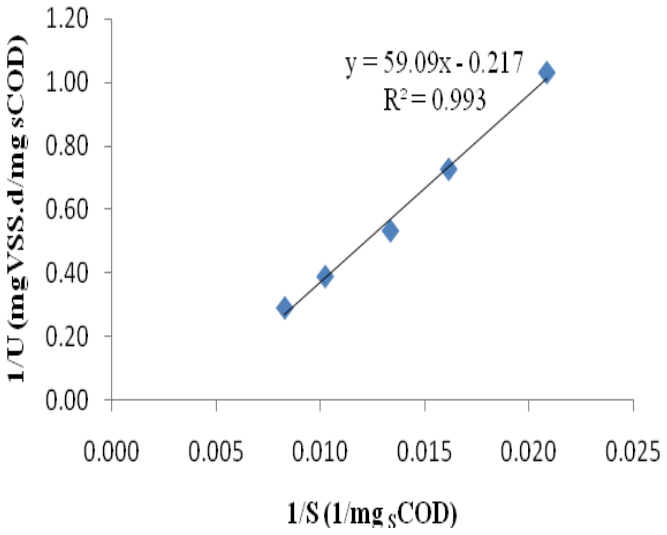

Figure 1. Determination of k and K_s for dairy effluent treatment plant

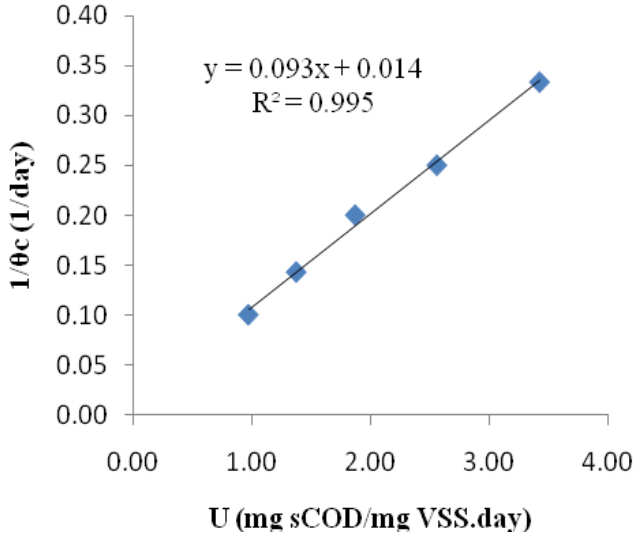

Figure 2. Determinations of Y and K_d for dairy effluent treatment plant

Table 5. Kinetic coefficients of various industrial effluent treatment processes

Coefficient	Unit	Lab batch reactor experimental values	Standard values
k	g bsCOD/g VSS day^{-1}	4.34	4-6
K_s	mg/L BOD mg/L bsCOD	535	400-500 (conventional process)
Y	mg VSS/mg BOD mgVSS/mg bsCOD	0.28	0.4-0.6
K_d	g VSS/g VSS day^{-1}	0.02	0.1-0.2

Table 6. Coefficients of laboratory scale batch process for dairy effluent treatment

Reference	k (day^{-1})	K_s (mg/l)	Y (mg VSS/mg BOD)	K_d (day^{-1})	Wastewater type
Metcalf & Eddy[8]	5	60	0.6	0.10	Municipal
Haydar and Aziz[9]	3.125	488	0.64	0.03	Tannery industry
Demirel[10]	9.3	482.5	0.20	0.25	Dairy (anaerobic treatment)
Bertola[11]	0.09	0.006	0.45	0.024	Potato industry
Gupta and Sharma[12]	0.216	56		0.068	Fertilizer industry

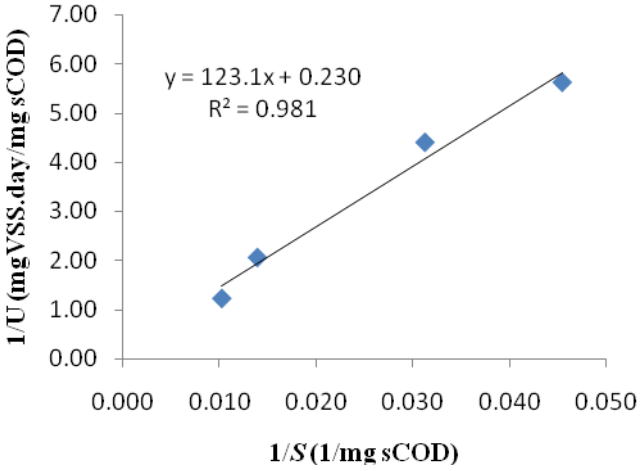

Figure 3. Determination of k and Ks for laboratory scale process

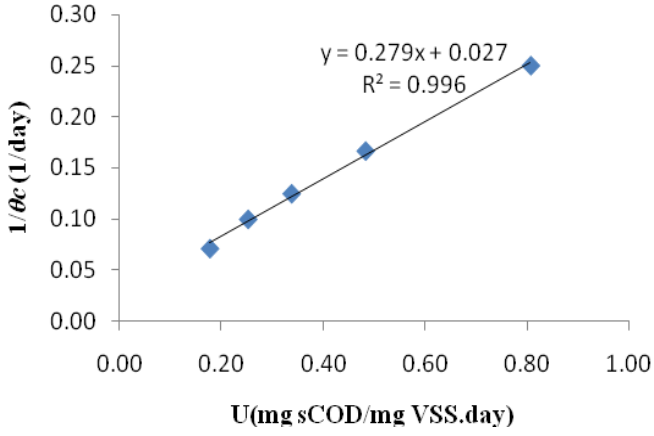

Figure 4. Determination of *Y* and K_d for laboratory scale process

Table 3. Kinetic coefficients of dairy effluent treatment plant

Coefficient	Unit	Value
k	g bsCOD/g VSS day^{-1}	4.60
K_s	mg/L BOD mg/L bsCOD	271.84
Y	mg VSS/mg BOD mgVSS/mg bsCOD	0.093
K_d	g VSS/g VSS day^{-1}	0.015

Table 4. Mean values of dairy effluent treatment parameters for laboratory batch process

Θ_c (days)	n[1]	S_o (mg/l)		S (mg/l)		X (mg MLSS/l)	
		Range	Mean[2]	Range	Mean[2]	Range	Mean[2]
3	4	4150-4370	4260±86	48-148	98±39	1202-1378	1290±69
4	4	3764-3916	3840±60	36-90	72±28	1244-1356	1300±44
5	4	3636-3724	3680±34	30-86	58±22	1278-1402	1340±49
7	4	3424-3536	3480±44	24-60	42±14	1310-1410	1360±39
10	4	3460-3580	3520±47	8-44	32±18	1236-1324	1280±34

correspond to all the amount of biomass produced by the growth during the removal of COD. The kinetic coefficients *k* (maximum substrate utilization rate), K_s (half velocity constant), *Y* (cell yield coefficient) and K_d (decay coefficient) were found to be 4.6 day^{-1}, 535 mg/L, 0.28 and 0.02 day^{-1}, respectively.

Conclusion

The determination of treatment kinetic coefficients may be helpful in (1) understanding the kinetics of substrate utilization (2) sludge production and (3) design of biological treatment facilities. Thus coefficients have both academic value and practical significance.

The kinetic coefficient values obtained of existing dairy effluent treatment plant: *k* (substrate utilization rate) was within the range and half velocity coefficient K_s and Cell yield coefficient (*Y*) were less than the other industrial effluent treatment processes. Decay coefficient K_d was quite less which indicates larger net sludge volumes resulting from biological treatment. Laboratory scale batch reactor studies showed that the kinetic coefficients *k* (maximum substrate utilization rate), K_s (half velocity constant), *Y* (cell yield coefficient) and K_d (decay coefficient) were found to be 4.6 day^{-1}, 535 mg/L, 0.28 and 0.02 day^{-1}, respectively which were in the range of other industrial wastewaters treatment processes.

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Effect of Pre-sowing Magnetic Treatment on Germination and Growth of *Triticum aestivum*

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Abstract: Germination is the action by which a plant grows from a seed. The most familiar example of germination is the sprouting of a seedling from a seed of an angiosperm or gymnosperm. Besides, the growth of a sporeling from a spore, such as the growth of hyphae from fungal spores, is also germination. Thus, in a universal sense, germination can be thought of as anything expanding into greater being from a small existence or germ. For enhancing the agriculture production and productivity the quality seeds are required. Seeds are generally considered as the backbone for improving yield and productivity and almost 25-30% increase in yield is possible due to high quality seeds. By the other point of view the agriculture based on high quality seeds is very important factor responsible for country's economic growth. In a present scenario, the demand of food in a continuous manner is thus found due to day by day increasing population and this situation has burdened the researchers to innovate new techniques in agriculture for increasing the production and productivity around the world.

INTRODUCTION

Use of magnetic field as a physical treatment to increase seed germination and emergence is considerably more safer and reasonable method in crop production systems[1-3]. Through many researches it is pointed out that the organic material of live organisms has a polar structure resulting from numerous polarized chemical bonds. The magnetic properties of them can be determined in the presence of particularly the dipoles of water molecules and dissociated mineral salts. The responses of plant species towards magnetic field are unpredictable. They are dependent on the intensity of magnetic field, the time of exposure to magnetic field, seed priming methods and species[4].It is proven that the positive effect of magnetic treatment may be due to the Para magnetic properties of some atoms in plant cells and pigments such as chloroplasts[5] .

Triticum aestivum is the most prominently consuming food around the world. It is a good source of proteins, minerals, Vitamin B complex and Dietary fiber. Generally, a wheat kernel contains 70% carbohydrates, 12% water, 2% fat, 12% protein, 1.8% minerals, and 2.2% crude fiber. It is also found enriched with phosphorus, zinc, magnesium, copper, manganese, selenium, iron, potassium[6-7].

By considering all the beneficial and adverse effect of exposure to magnetic field on crop seed, determination of optimum intensity of magnetic field and duration of exposure are mandatory prior to undergoing such an investigation. Hence, seed technological studies were conducted by using different intensities of magnetic field with duration of exposure to find out the seed quality attribute crop *Triticum aestivum .*

MATERIALS AND METHODS

Treatment of seeds

Before magnetic exposure, seeds were given primary treatment. The seed of Wheat were socked in tape water for over night to make for skin softer. Than after Treated seeds were

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divided in to 4 groups, with 5 seeds in test-tube distributed all group, than treated further with static magnetic field of different magnetic level for different time exposure. One group considered as control, without exposure of magnetic field. Two main factors first one is magnetic field intensity and second is duration of exposure are designed for seeds under analysis. The factor details are magnetic field intensity, Duration of exposure.

Then First experimental sets were designed for 50mT for 5min, 10min and 20min. Second experimental sets were designed for 100mT for 5min, 10min and 20min. Third experimental sets were designed for 200mT for 5min, 10min and 20min. Then seeds were incubate for germination in to sterile Petri plates and then in pot experiment. The experiment were perform at room temperature.

Shoot length (in cm)

After germination, five normal seedling were selected from each treatment and shoot length was measured from the primary leaf of base of mesocotyl and mean shoot length was measured.

Pot experiment

After the measurement of shoot and Root length the pot experiment was performed on the pre-sowing magnetictically treated selected seeds of Wheat with different magnetic field intensity 50mT, 100mT and 200mT for different time exposure 5min , 10min, 20min and control . The pot experiment was conducted in uniformly black clay soil. and PVC pot were filled with black clay soil with appropriate organic matter ,with pH 7.25 and seed for each plant in to the PVC pot on 23 may, 2015. The Pot experiments were arranged in the randomized block design with two replication and growth period. For maintaining moisture in the pot, suitable amount of water pour per day. The temperature was maintained for best growth and yield. The results were recorded for month like measurement of plant height, dry weight, wet weight of plant. Biochemical tests were performed on the grown plants.

Dry and wet weight of plant (gm/plant)

The normal plant was put in paper and put it in hot air oven 65 to 70◦c for 5 hr, after drying plant was cooled off. And the weights of plant were recorded.

Table: 1 Number of seeds germinated out of 5 seeds in Wheat.

mT/min	50mT					
	Day1	Day2	Day3	Day4	Day5	Day6
Control	0	1	2	3	3	4
5min	0	3	4	4	5	5
10min	0	1	1	1	2	3
20min	0	1	1	1	2	3
	100mT					
	Day1	Day2	Day3	Day4	Day5	Day6
Control	0	1	2	3	3	4
5min	0	1	2	1	3	5
10min	0	1	1	1	2	3
20min	0	0	0	1	1	2
	200mT					
	Day1	Day2	Day3	Day4	Day5	Day6
Control	0	1	2	3	3	4
5min	0	2	2	3	3	3
10min	0	0	0	0	2	4
20min	0	0	1	2	4	5

RESULT AND DISCUSSION

Seeds Germination in Wheat (Petri plate experiment)

Wheat seeds which were treated by magnetic field were germinated earlier then non treated seeds (control). After the 6 days of soaking early germination were achieved in magnetized seeds, while it was late germination in non treated seeds. The highest germination rate was achieved for exposure of seeds for 5 min 50mT, 100mT and 20min, 200mT magnetic field However, no significant difference was observed between other seedA MF applied to dormant seeds was found to increase the rate of subsequent seedling growth of barley, corn (Zea mays), beans, wheat, certain tree fruits, and other tree species [5].

Shoot length in Wheat (Petri Plate experiment)

Shoot growth observation shows considerable differences among treatments, which are depicted in table 3: The highest values in shoot length were observed on 10th day for 50mT for 5min, 100mT for 10min, and 200mT for 10min. Among these highest shoot length of 4.8cm was observed in 50mT magnetic field for 5 min exposure. Treated corn plants grew higher and heavier than control, corresponding with increase of the total fresh weight. The greatest increases were obtained for plants continuously exposed to 125 or 250 mT [8].

Height (in cm) of Wheat plant in (pot experiment) The growth of Wheat plant for measurement of height after 20th days with control, 50 mT, 100 mT and 200 mT magnetic field intensity for 5 min, 10 min and 20min exposure.

Table 2: shoot length of wheat plat after the application of magnetic field

mT/min	50mT				100mT			
	Day7	Day8	Day9	Day10	Day7	Day8	Day9	Day10
Control	2.8	3	3.4	3.9	2.8	3	3.4	3.9
5min	3.1	3.8	4.1	**4.8**	2	2.8	3.4	4.2
10min	2.7	3.6	4.2	5	2.8	3.4	4	**4.3**
20min	2.4	3.1	3.5	3.8	2.5	3	3.2	3.8

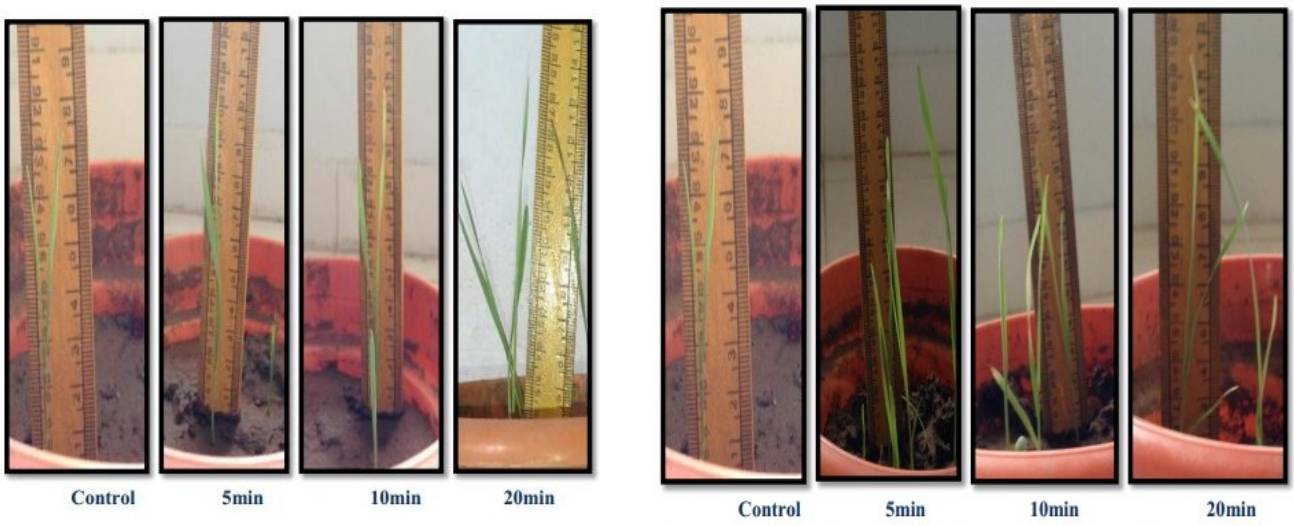

Figure 1 The growth of wheat plant in pot experiment after 20th day in 50 and 100 mT

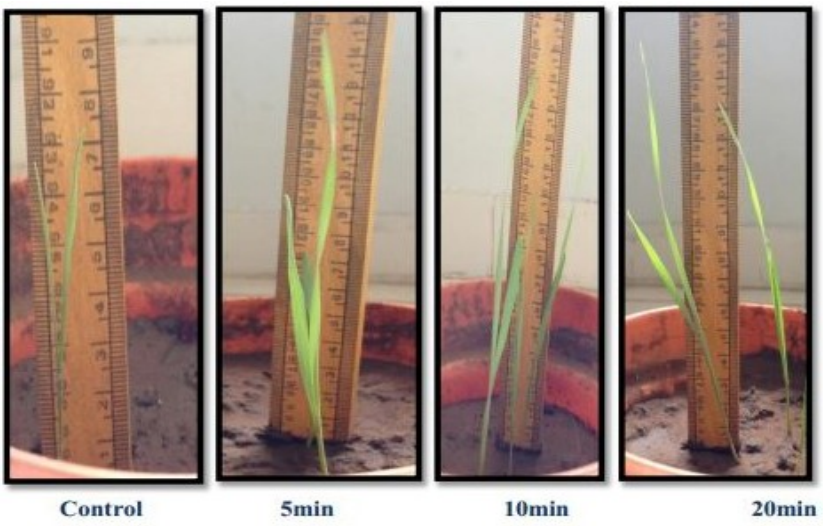

Figure 2 The growth of wheat plant in pot experiment after 20th day in 50 and 100 mT

Conclusion: The study indicates that pre-sowing treatment induced the beneficial effect on the physical, biochemical features and yield of Wheat seed. However, further study still required understanding the basics of magnetic field effect, but the obtained result shows some positive change due to such kind of treatment. The result indicates that the effects of magnetic field Intensity as well as duration of exposure influence growth of plant. The significant improvements were seen in growth and yield of both the plant as compared to their controls, due to pre-sowing magnetic treatments.

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