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# Comparative study of organic Polyelectrolyte in Municipal wastewater treatment

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**Abstract:** Thecomperative study was carried out for COD removal from municipal wastewater. The two organic polyelectrolyte was prepared on Laboratory scale. The first was Carboxymethyl Chitosan(CM-Chitosan) and second was Carboxymethyl Cellulose(CM-Cellulose) . Both are the derivative of Chitosan and Cellulose. The Chitosan was extracted from shells of Indian prawn (Fenneropenaeus Indicus) commonly known as white shrimp. The Carboxymethyl Cellulose was prepared from cotton fiber (Gossypium Arboreum). The results shows that COD removed by Carboxymethyl Chitosan between 73.56-77% at optimumDose of 0.4mg/100ml while Carboxymethyl Cellulose removed 43.3-55.3%

**Keywords**: Alkylation, Bio waste, Municipal, optimum dose

## 1. INTRODUCTION

Water is life, the unplanned industrial development, population growth and untreated effluent discharge in water bodies cause life threat on earth crust. The fresh water reservoirs are limited on earth. The 97% of total water is sea and ocean and is salt water. The 3% of remaining water exists in polar ice cap glaciers, underground or atmosphere. The only 0.4% is easily approachable fresh water for use.(Special Report WWF for a living planet 2007). Pakistan is facing the provision of safe drinking water to public. The water scenario of Pakistan (2004-2025) indicated that water shortfall increases from 11-31 MAF (million acre foot) (Rokshana. 2005). against the availability 104 MAF, therefore it needed to preserve the fresh water resources. The objective of this research was to develop the organic biopolymer from indigenous sources having high tendency for COD removal from municipal wastewater.

The Pakistan fishing profession is growing day by day; moreover it provides employment to 400,000 people directly(Rabia 2007) The total coastal area is 1120 km and total fishing area is 300,270 sq. km. A large quantity of bio mass generated from the waste of sea animal processing industries. In local and international market the shrimps /prawn shells head and tail discarded and meat portion sold. The part of discarded mass was peel and utilized as poultry feed, soil land fill or fish feed. The 40 -45% has no use dump near coastal areas creating land pollution concerns (Zeenat 2013). The prawn /shrimp waste contain many valuable components including protein, bio polymers chitosan, chitin and astaxanthin and color pigments. It was estimated that south east Asian countries can earn 24000US$/year from chitosan recovery from prawn /shrimp waste (Zeenat 2013). The second objective of study was to prepare the CM- Chitosan from Chitosan by direct alkylation method. The chitosan used in this research work was extract by chemical method from Indian prawn/white shrimp (*Fenneropenaeus Indicus*). The CM-Chitosan is water soluble derivative of Chitosan and prepared by alteration of amino group and hydroxyl group in chitosan chain. CM-Chitosan have unique characteristic regarding water and waste water treatment.

Pakistan is world's fourth-largest cotton producer and the third largest exporter of raw cotton agricultural country. The cotton "white gold" is cash crop and contribute 3.2% to GDP of Pakistan. It provide employment in rural and the urban areas to more than 20 million people.

Cotton is a soft, white fluffy staple fiber that grows in a protective capsule, around the seeds of cotton plants of the genus Gossypium. The cotton fiber is pure cellulose. The CM-Cellulose is cellulose derivative commonly known as sodium carboxymethyl cellulose can be used for water purification. The study presents the preparation method of CM-Cellulose from cotton fiber and its effect on COD Removal of municipal water.The comparative study of CM-Chitosan and CM-Cellulose on COD Removal of municipal water was developed at their optimum dosage.The indigenous source of extraction of provide safe disposal of bio mass waste.

## PREPARATION METHODS

The present study was carried out to evaluate the performance of CM-Chitosan and CM-Cellulose prepared on laboratory scale. The preparation method of both given below

### A. Preparation of CM-Chitosan

The CM-chitosan was prepared from chitosan. The chitosan is present in Indian prawn or white shrimp (*Fenneropenaeus Indicus*) so it was extracted by chemical method. The Chitosan is the derivative of Chitin and was comprises of many hydroxyl group (-OH) and amino group

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on molecular chain. The CM-chitosan is water soluble chitosan derivative and prepared by direct alkylation process The preparation process started by adding 40% sodium Hydroxide solution in the suspension of chitosan and isopropanol .The suspension was made of 3gram Chitosan verse 65ml isopropanol (Fluka). Then the solution of 14.4% monochloroacetic acid (Merk Germany purity 99.8%) in isopropanol was added and kept for five hours at room temperature till the reaction completes. It was than filtered, washed with 100 ml methanol (Merk) and was neutralized by glacial acetic acid (Merk). The suspension was filtered, dried and ground before that absolute ethanol (Merk) was added to make it in organic phase.

### B. Preparation of Carboxymethyl Cellulose

The cotton fibers of G. arboreum species and Malvaceae family belonging to kingdom Planate was selected for the preparation of CM –Cellulose. The 25 gram cotton fibers (Gossypiumarboreum) were soaked in 30% sodium Hydroxide solution (aq) for five hours. It was filtered and added 40% Monochloroacetic acid (aq) and heated and stirred by magnetic stirrer at 75ºC. The 25ml isopropanol (Fluka) used as solvent. Finally it was washed by water and dried.

### C. Characterization:

The Thermo gravimetric analysis (TGA) was carried out in PCSIR Labs Karachi on Netzsch TC 209Î L Libra Thermal Analyzer under nitrogen environment in order to analyze the effect of temperature on the structure and weight of CM-Chitosan and CM-Cellulose. The thermal degradation of CM-Chitosan took place in three stages **(Fig1).** The moisture lost between 35 $^{o}$C - 240 $^{o}$C, the cyclized product (containing C-O-C group ) decomposed from 111 to 240 ºC, and–C-O-O- groups removed from polysaccharide from 241to 290ºC and was possibly of -$NH_2$ groups detachment in the form of ammonia ($NH_3$).The TGA Curve of CM-Cellulose showed degradation at two stages **(Fig 2).** The first zone and second zone attributed the weight losses due to moisture content and carbon dioxide removal from the polysaccharide and decarboxymethylation in CM-Cellulose respectively.

### D. Sample collection:

The CM-Chitosan and CM-Cellulose were effective chitosan derivative and cellulose derivative used for COD removal of municipal water. The ten water samples were taken randomly from Hyderabad city Sind province. According to standard procedure the sampling were done and was analyzed without delay.

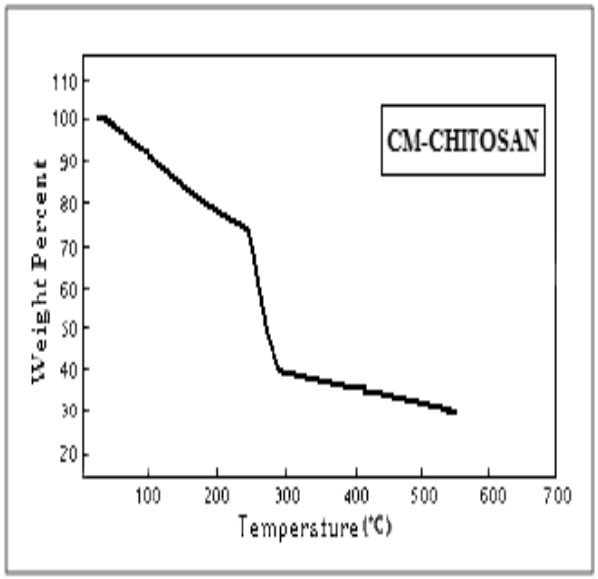


**Fig 1. Thermogravimetric Analysis of Carboxymethyl Chitosan**

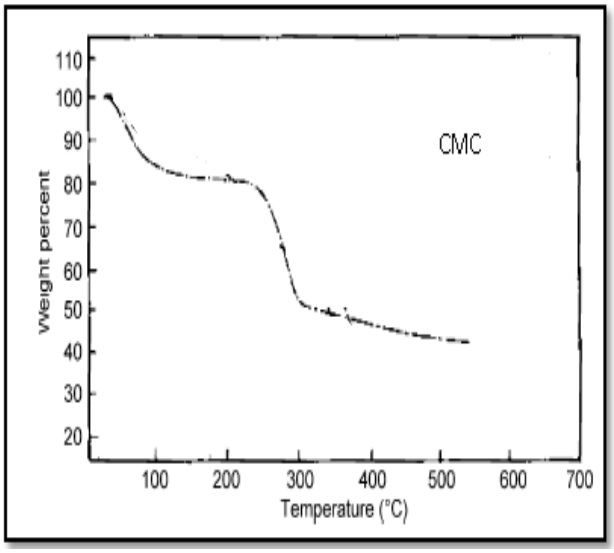


**Fig. Thermogravimetric Analysis of Carboxymethyl Celluloses**

### E. Dose optimization

The determination of optimum dose the five samples were analyzed randomly. According to results the 0.4mg/ 100ml was the optimum dosage of CM-Chitosan **(Fig 3).** At this COD removal occurred 73.8-78.4% and above the optimum dosage the COD removal was slowly decreased.The optimum dosage of CM-cellulose was noted from 0.7-1.3 mg **(Fig 4).** The finding showed that 1.1mg was the optimumdose at which the mean COD removal was 57.02%.

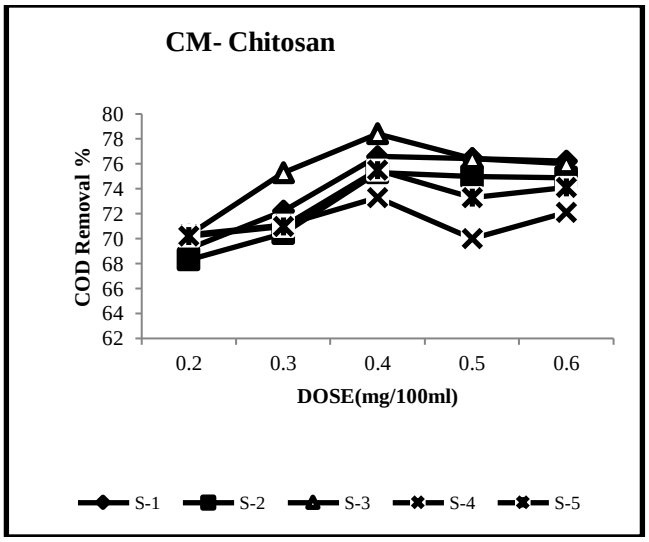


**Fig 3 : The optimum dosage (mg/100ml) of CM-Chitosan on COD removal % of municipal waste water sample**

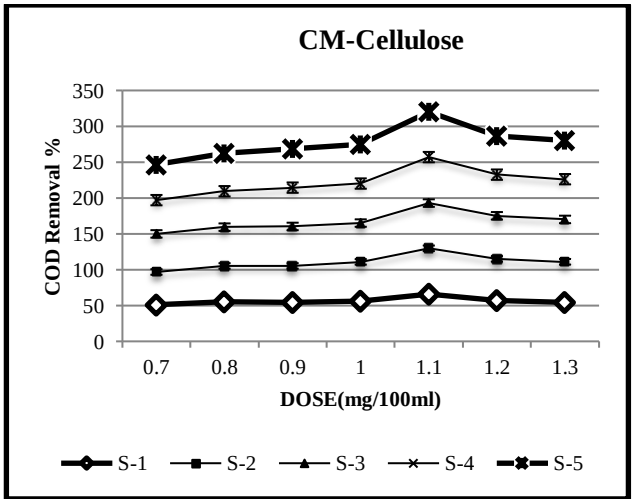


**Fig 4: The optimum dosage (mg/100) for COD removal % of municipal waste water**

## 2. RESULTS AND DISCUSSIONS

The CM-Chitosan and CM-Cellulose were applied at optimum condition of doses. The comparative studies were developed. According to results the CM-Chitosan was the most effective chitosan derivative which reduces the COD up to 77%. The mean values of ten samples were stood 75.25%. The minimum and maximum range were 73.56-77%. It was happen because of active amino group and hydroxyl group. The CM-cellulose showed the COD removal range between 43.3%-55.3%. The absence of amino group reduced its COD removal efficiency.

## 3. CONCLUSION

The chitosan and cellulose derivatives named CM-Chitosan and CM-Cellulose were prepared on laboratory scale and applied for COD removal of water samples. The CM- Chitosan was found better for COD removal from municipal water samples at optimized dose condition.

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