Effect of Dairy Effluent on chlorophyll pigmts and various carbohydrate fractions of *Lens culineris, Medik*

[1]Shilpi Rashmi, [2]Dr. R.K.Sinha

Plant Physiology & Biochemistry Laboratory
Department of Botany, Patna University, Patna 800005

***Abstract*: Chlorophyll contents increased at 20% concentration of effluent and the gradually decreased at higher concentrations.**
Reducing sugar was found to be nil in seeds. Total soluble sugar, non-reducing sugars and starch increased at lower concentrations (Maximum at 20% effluent concentration) while decreased at higher concentrations of effluent.

***Keywords*: Effluent, Chlorophyll, Reducing sugars, Non-reducing sugars, soluble sugars and starch.**

Introduction: Dairy effluents are waste waters discharged from the Dairy firms/industries due to typical firms activities. Dairies are milk processing plants which manufacture Ghee, Cheese, Butter, Curd, Sweets, Ice-creames, Lassi etc.
Discharge of effluent having toxic chemicals leads to degradation of water quality *(Bartram & Balance 1996.* Treated effluent at low concentration is liquid fertilize*r (Bisnoi & Gautam 1991).*
For the present study, aleguminous, herbaceous rabi crop namely lentil (Lens culineris) has been selected for experimentation due to its high protein & carbohydrate content. Due to its high starch content, it is also used in textile and Calico printing industries.

This corp is widely cultivated in sub tropical & temperate regions of the world. In India, it is grown in Bihar, UP, MP, Rajasthan,Punjab, Haryana, West Bengal, Maharashtra & Jharkhand.

Material and Methods: Treated, dairy effluents were collected at regular intervals during experimentation in polythene canes from Food & Balancing Dairy Phulwarisharif , Patna.

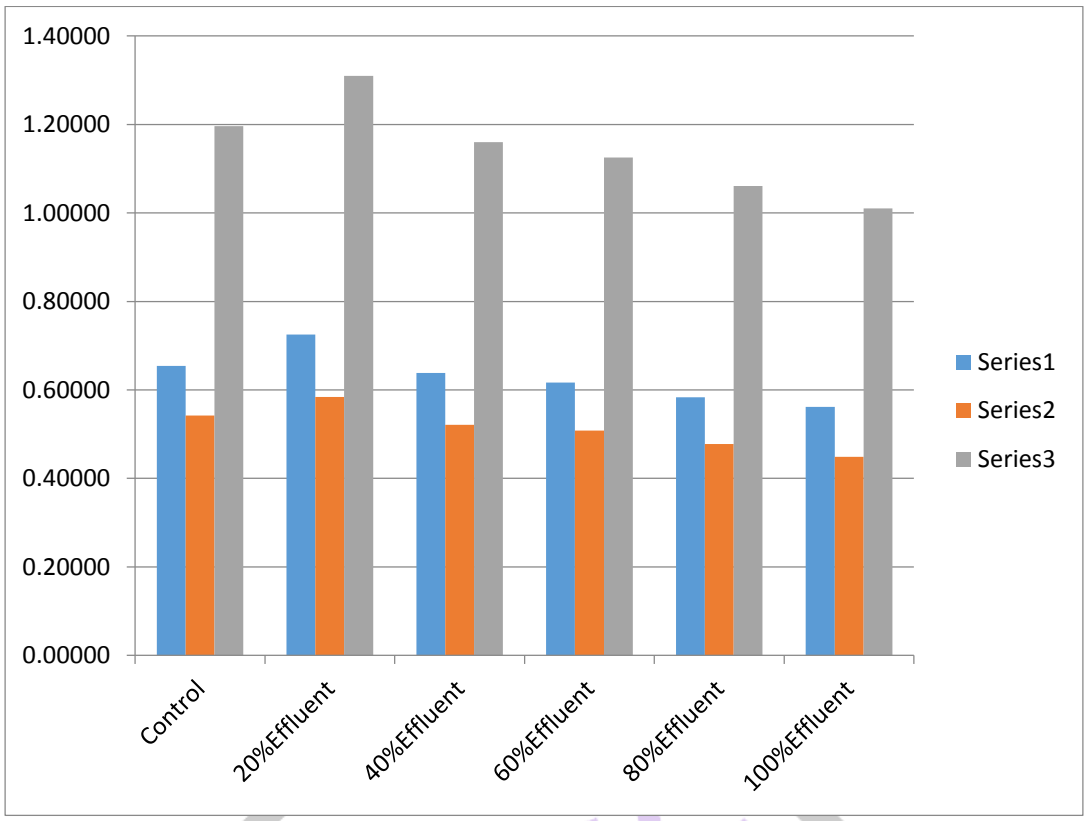
The lentil seeds variety BR-25 were had from agriculture firm , Mithapur,Patna ,Bihar. Different grades of effluents were prepared by diluting the effluent with tap water. Effluent collected as such (without dilution) was considered as stock solution.

The lentil plants were planted in labelled earthen pots filled with garden soil. The amount of soil was equal in all the pots. The plants were irrigated with equal volume of water twice in a week.
Chlorophyll a , chlorophyll b & total chlorophyll were determined as per standard method o*f Arnon(1949).*
Total soluble water was extracted according to Sane & Zalik(1970) and determined by the method of *Yemn & Wills(1954).*

Reducing sugar was extracted as per method of *Sane &Zalik (1970)* estimated after *Fairbridge et,al (1951).*
Extraction of starch was done according to *Hassid & Neufeld (1964) and* determined afte*r Yemn & Willis (1954).*
Observation and result: The plants treated with 20% dairy effluent concentration, showed an increase of 0.11321mg/gm in total chlorophyll content over control. The increase in chlorophyll a was 0.14098mg/gm and chlorophyll b was 0.04213mg/gm. It started decreasing after 20%(Table 1 & Histogram 1).
Carbohydrate components of the seeds of plants treated with 20% concentration of effluent showed high amount of non-reducing sugar and total soluble sugar but no reducing sugar.
Reducing sugar was nil in all the concentrations except 100% where it was 0.02. At 20% concentration, starch content was increased. Total soluble sugar was 1.12% more and starch was 9.5% more than control. Over 20% effluent concentration it decreased(Table 2 & histogram 2).

Table - 1

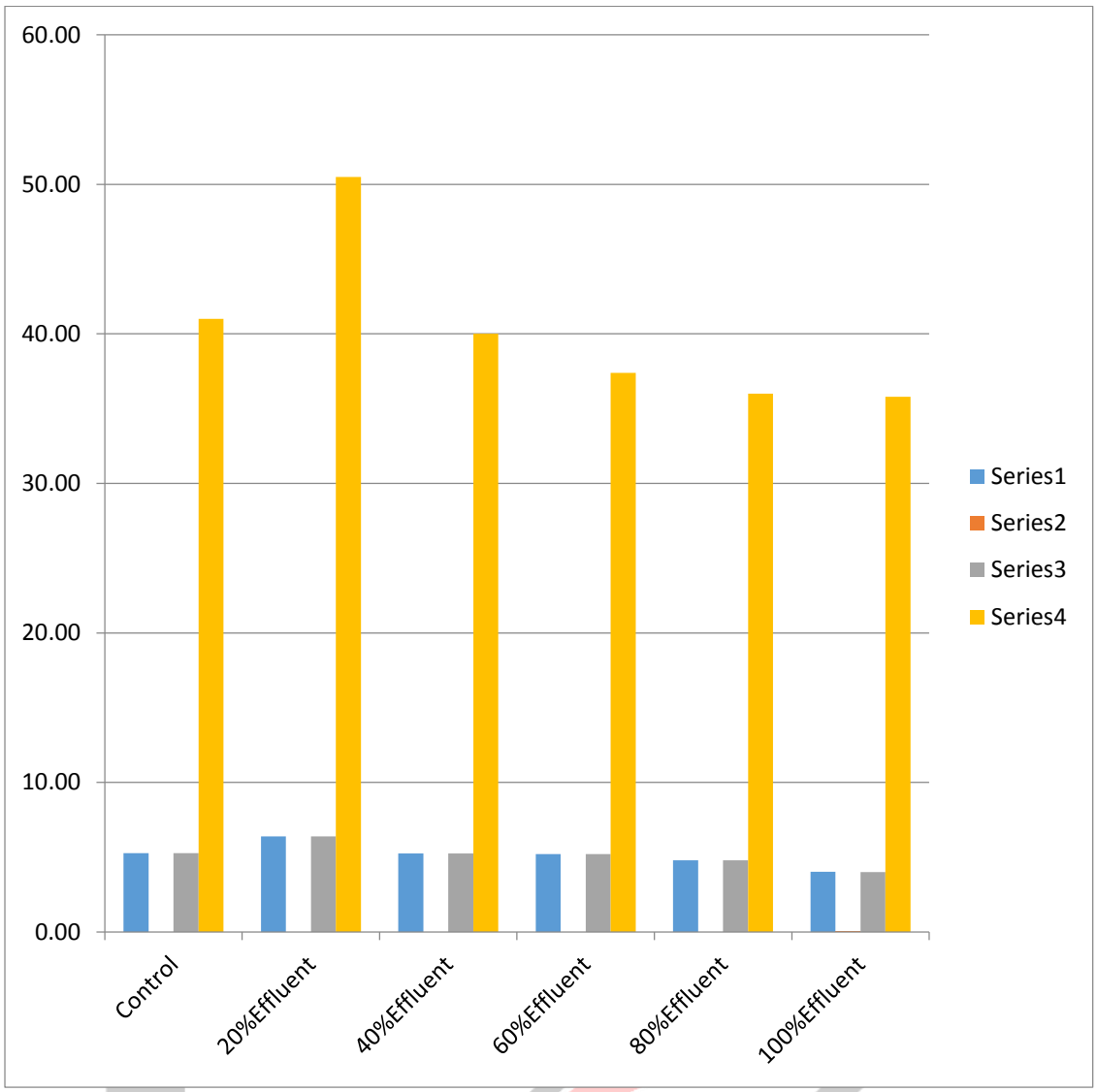
Amount of Chlorophyll in mg/gm fresh Tissue			
Treatment	**Chlorophyll 'a'**	**Chlorophyll 'b'**	**Total Chlorophyll**
Control	0.65424	0.54221	1.19645
20%Effluent	0.72532	0.58434	1.30966
40%Effluent	0.63852	0.52112	1.15964
60%Effluent	0.61661	0.50843	1.12504
80%Effluent	0.58324	0.47768	1.06092
100%Effluent	0.56126	0.44872	1.00998



Histogram - 1

Table - 2

Percentage Carbohydrate fractions in Seeds				
Treatment	**Total Soluble Sugar**	**Reducing sugar**	**Non Reducing Sugar**	**Starch**
Control	5.28	0	5.28	41
20%Effluent	6.40	0	6.4	50.5
40%Effluent	5.24	0	5.24	40
60%Effluent	5.20	0	5.2	37.4
80%Effluent	4.80	0	4.8	36
100%Effluent	4.02	0.02	4	35.8



Histogram-2

Discussion: Chlorophyll content increased at 20% concentration of the effluent and then decreased at higher concentrations.Increase in chlorophyll might be due to high nutrient uptake probably facilitated by optimum availability of iron & magnesium along with reduction of phenol in treated/diluted effluent which might favour more synthesis of chlorophyll while decrease at higher concentration might occur due to less/non availability of required amount of iron and magnesium due to physiological dryness.

Increase in chlorophyll at lower diary effluent concentration finds support from *Nagda et al (2006)* and decrease at higher concentration by *Pandit et al (1996).*

A decrease in chlorophyll content in effluent treated seedlings suggested pollution injury *(Pragasam & Kannbrian 2001).*

Changes In pigment concentration might affect carbohydrate synthesis.Hence decrease in chlorophyll content would lead to decrease in carbohydrate fractions.

Reducing sugar were found to be nil in seeds .Reduction / absence of reducing sugar might be due to conversion of reducing sugar into non -reducing sugars and starch as seeds are food storage sites of plants. Huber(1983) has reported that starch and sugar both cannot be high or low together in a particular case. Increased concentration of one substance occurs at the cost of the other.

The non- reducing sugar / total soluble was found to be increased in the present study at lower concentration (20%). It might be due to conversion of reducing sugar into starch and non-reducing sugar.

As seeds were dry no hydrolysis of starch occurred. Hence increase in non reducing sugar was due to conversion of reducing sugars into non-reducing sugar.

Accumulation of non reducing sugars might be might be due to more photosynthesis which is dependent upon number of leaves.Here more number of leaves were found at 20% concentration. Hence maximum accumulation of non-reducing sugar thereby total soluble sugar occurred at this concentration (as total soluble sugar is the sum of reducing sugar and non-reducing sugars. Here reducing sugar is nil hence total soluble sugar = non reducing sugars).

Starch content also got increased at 20% concentration over control and other treatments. It might be due to conversion of more sugars into starch for storage. However, decrease in starch content at higher concentration might be due to the lowered activity of phosphorylase and increased activity of β amylase and invertage. Chlorophyll estimation also revealed better growth at 20% concentration.Thereby more soluble & reducing sugars. As reducing sugar is immediate fuel of respiration and the dry seeds have declined their respiration rate to minimum level. There is no need of reducing sugars accumulation.
Further ,reducing sugar is not storage form of carbohydrate & seed is store house of carbohydrate. There is more starch & non reducing sugar but less or nil reducing sugar.

According to *White(1936)* starch -sugar balance determines average frond area and number. More starch and less sugar are associated with decrease in frond numbers and areas.

Acknowledgement: Authors are thankful to HoD Botany,Patna university for providing Laboratory & Library facilities.

References:

Arnon D.I (1949): Copper enzyme isolated chloroplast polyphenol Oxidase in *Beta vulgaris - Plant . Physiol 24, 1-15.*

Bartram J and Balance R (1996**):** Water quality monitoring. A practical guide to the design & implementation of fresh water quality . Study and Monitoring programmes. UNEP & WHO.

Bishnoi S and Gautam D.D(1991): Effect of dairy effluent on seeds germination and seedling growth of some crop plants, Int. J. Eco.Environ.Sci.17(1)67-71.

Fairbridge R.A wills K.J. and Booth R.G.(1951): Colorimetric determination of reducing sugar in Modern method of plant analysis (Ed. Paech K and Tracoy M.V.) Vol -II, PP-41, Springer, Berlin .

Hassid W.Z and Neufield, E.F.(1964)**:** Quantitative determination of starch in plant tissue ,Method in carbohydrate chemistry ed.Wistler R.L ,4 ,33-16

Huber S.C(1983): Relation between photosynthetic starch formation and dry weight partitioning between the shoot and root. *Can.J .Bot.61,2709-2716.*

Nagda G.K,Diwan A.M. and Ghole V.S.(2006) **:** Seed germination bio assays to asses toxicity of molasses fermentation based bulk drug industry effluent . European J. Environ & Agriculture. Food .Chem.5(6):1598-1603.

Pandit B.R, Prasannakumar P.G and Mahesh Kumar (1996)**:** Effect of dairy effluent on seed germination,seedling growth and pigments of *Pennesetum typhoids*, Barm and *Sorgham bicolour* L, *Pollution Researc*h15(2):121-123.

Pragasam A and Kannabiran B(2001) Effect of distillery effluent on the photosynthetic pigments and nitrogenous compounds in *Vigna mungo*,L. Heper .J. Samy.Bot.Cl. 18,21-23.

Sane P.V. and Zalik S(1970): Metabolism of acetate 2-C glycine 2-C, leucine U-C and effect of S- aminolevulinic acid on Chlorophyll synthesis in gateway barley and its mutant. *Can J. Bot* , 48, 1171-1178.

White,H.L(1936): The interaction of factors in the growth of Lemna vii. The effect of potassium growth and multiplication. Ann.Bot,50,175-196.

Yemn,E,W and Wills, A.J(1954): The estimation of carbohydrate in plant extract by anthrone : *Biochem J.* .57, 508-514.