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Original Article

Smart production of spirulina (*Spirulina platensis*) using supernatant of digested rotten potato (*Solanum tuberosum*)

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Spirulina, Potato, Growth, Kosaric medium, Optical density.

A B S T R A C T

The study was conducted to evaluate the culture and growth performance of spirulina (*Spirulina platensis*) in supernatant of three different amounts of digested rotten potato (DRP), and Kosaric medium (KM) as control in 16 days after 26 days digestion. Three different concentrations such as 20, 40 and 60% of DRP were used. Spirulina was inoculated in supernatant DRP along with 9.0 g/L $NaHCO_3$ and micronutrients, and KM for a period of 14 days. The cell weight of spirulina was attained a maximum of 12.42 ± 0.21 mg/L in KM followed by 8.352 ± 0.21, 6.256 ± 2.34 and 9.505 ± 0.43 mg/L in supernatant of 40, 20 and 60% DRP, respectively on the 10th day of culture. Similar trend was also observed in the cases of optical density, chlorophyll a, total biomass, specific growth rates. Cell weight of spirulina grown in the media were highly significant ($p<0.01$) and correlated with the chlorophyll a content and total biomass. The growth performance of spirulina grown in supernatant of 60% DRP was significantly higher than that of spirulina grown in supernatant of 20 and 40% DRP. Therefore, mass culture of spirulina may be done in supernatant of 60% DRP.

Introduction

Spirulina is a multi-celluar, blue-green algae. They are very small and microscopic and 300-500µm in duration. Sizeable amounts of phosphorous, magnesium, zinc and pepsin discovered in spirulina. The cellular wall of Sizeable amounts of phosphorous, magnesium, zinc and pepsin discovered in spirulina. The cellular wall of spirulina includes polysaccharide which has 86% digestibility and could be easily absorbed in human body (Li., 1995). Many elements are critical for the manufacturing of spirulina at huge scale of which most critical are nutrient availability, temperature and mild intensities. The filamentous cyanobacteria such as spirulina are observed to be most well suited microorganisms for the utilization of waste and waste water as they're capable of produce big quantity of biomass and their harvesting is likewise fantastically clean due to their shape. Also these wastes reduce the fee of nutrient medium and act as a source of cheap nutrient medium for cultivation of spirulina. Business genesis of spirulina can be made price effective by reducing the enter value with penny and effectively to be had materials without sacrificing the manufacturing efficiency. After taking 10g spirulina drugs per day for 4 weeks, woman athletes showed increase in their homo chrome level, whereas the male athletes did not show any obvious increase however lung capacity of youth weight lifting and jujutsu athletes become progressed. The spirulina pill had no effect on blood pressure (Gerald *et al*., 1983). Spirulina could serve as an auxiliary cure for many diseases which have shown by clinical traits. Spirulina pill has improved the coalitions in lowering blood lipid stage and in reducing white blood corpuscles after radiotherapy and chemotherapy in addition to reducing immunological feature (Ruan *et al*., 1990). Spirulina (*S. platensis*) is a "super-food" among the most plants and even good quality animal food Ronald *et al*., (1990). It has a rich, vibrant history and occupies an intriguing biological and ecological niche in the plant kingdom. Spirulina is a spiral-shaped, blue-green microalgae that grows naturally in the wild in alkaline lakes, sea water and saltwater. Its deep blue-green colour what gives the water its greenish hues. For centuries, civilizations the world over cultivated and cherished spirulina for its health-improving benefits (Habib, 1998). It has been used last ten years as a

model organism in many studies on outdoor cultivation of algal biomass as a source of proteins and chemicals (Richmond, 1988). Spirulina species not only contribute in human health but also plays considerable role as animal feed. It increases the yellowness and redness in broiler flesh when spirulina fed with diet (Habib *et al*., 2008). With the expansion of aquaculture in Bangladesh, there has been an increasing trend in using chemicals in aquatic animal health management (Uddin *et al*., 2020). Spirulina is very much helpful for fish health. We can use spirulina rather than using chemical in aquaculture. Spirulina has been consumed from a very long term in lots of parts of the sector as a food supplement for human as well as animals in diverse paperwork like wholesome drink, drugs and powder so on. Because of its alimentary value. The primary generation biofuels basically produced from vegetation compete with different meals crops for arable land and are these days inclined as secure and reliable renewable energy sources. The second generation biofuels made out of non-meals feed stocks, specially being microalgae; had been paid increasing interest to compare with the first era biofuels. There are a few blessings for microalgae together with high productiveness, much less land use, low requirement of water excellent, environmental use (for wastewater treatment and carbon dioxide (CO_2) bio-mitigation), Wijffels *et al.* (2010). Microalgae play a vital role in oxygen in addition to carbon dioxide stability within the water. It acts not most effective on agro-chemical but additionally animal wastes as nicely through changing them into meals substances. As why spirulina offers: approximately 60 percent complete digestible protein, round 6-10 percent lipids, micro-vitamins, macro-vitamins and lots of other hint factors. It contains every essential amino acid, contains more carotenoids than any other whole food and this is an excellent source of vitamins A, K, B_1, B_2, B_{12} and iron, manganese, chromium etc. (Becker 2007). Can be a higher source of gamma linoleic acid (GLA) - an vital fatty acid, that is essential for human fitness. It plays a treasured position in mind functions in addition to normal growth and improvement. In food industries it performs various capabilities as a thickener, binder, disrupting agent, stabilizer, texture modifier, gelling and a bulking agent, useful in the upkeep of canned and frozen meals, in the system of syrups, essences 1423 and drinks, in confectionery and bakery, snacks, backery and mushroom lets in (Burrell *et al*., 2003). Therefore, to accelerate the improvement of aquaculture industry, it's far critical to way of life spirulina.

The closing purpose of this experiment turned into to expand low fee media for huge scale manufacturing of spirulina. Those rotten potatoes or spoiled potato are thrown as waste material out of doors which decomposes and creates environmental risks. However it carries excessive damaged natural and inorganic vitamins, and high biological oxygen call for (BOD) and chemical oxygen demand (COD), total dissolved solids, general suspended solids, nitrate, phosphate and additionally inorganic vitamins (Habib, 1998). Those organic and inorganic nutrients rich in carbon can help to develop *S. platensis* in supernatant after cardio or anaerobic digestion of potatoes. Potato has the suitability and efficacy as prebiotic compound on the growth performance and survival rate of fish (Islam *et al.*, 2020). Therefore, the prevailing work was undertaken to take a look at the smart production of spirulina by means of supernatant of digested rotten potato (*Solenum tuberosum*) to measure the growth performances of *S. platensis* in 3 exclusive concentration of supernatant of digested rotten potato.

Materials and Methods

Study area

The study was performed inside the Laboratory of Fish Nutrition, Department of Aquaculture, Water Quality Laboratory within the department of Fisheries Management and Genetics Laboratory in the department of Fisheries Biology and Genetics, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202.

Culture of microalgae, Spirulina

Collection of rotten potato

The rotten potato become selected as medium for *S. platensis* culture because of presence of excessive natural in addition to inorganic vitamins specifically carbohydrate. The rotten potato becomes accrued from Seshmore market, BAU, Mymensigh. It became reduce into portions and used to digest in cardio circumstance, some element become dried, floor, packed in polythene bag and kept in the laboratory for future use.

Collection of spirulina (*S. platensis*)

Microalgae *Spirulina platensis* was collected from the stock of the laboratory of Live Food Culture department of Aquaculture, BAU, Mymensingh. For obtaining pure culture of spirulina maintained hygiene stock Torzillo *et al.,* (1986).

Maintenance of pure stock culture of spirulina

Pure stock culture of *S. platensis* was maintained in the laboratory in Kosaric Medium (KM) (Modified after Zarrouk, 1996). Growth of *S. platensis* was monitored at every alternative day and was checked under microscope to confirm its purity following keys of Bold and Wynne (1978), Vymazal (1995) and Phang and Chu (1999).

Preparation of supernatant of DRP and Kosaric Medium (KM)

400 g/4.0 L wet rotten potato was allowed to decompose in 5.0 L glass bottle for 26 days under aerobic condition (Plate 1) in the laboratory of Animal Nutrition, BAU, Mymensingh. Then a Light reddish white coloured supernatant from bottle was screened through a net of 30 µm, mixed with 9.0 g/L sodium bicarbonate and 0.20 ml/L micronutrient, then diluted and made three concentrations at the rate of 20, 40 and 60% of decomposed rotten potato (Table 1). Then the supernatant of three different concentrations were taken in 2.0 L flask with three replications. Simultaneously, Kosaric medium (KM) was prepared for *S. platensis* culture as a control (Table 2). Then the medium in flasks have been blended properly and sterilized at 120°C for 15 minutes for 15 minutes with wet warmth with the aid of autoclave. After autoclaving, the media were saved for 24 hours to make certain approximately any infection loose earlier than lifestyle of microalgae.

Table 1. Experimental design for *Spirulina platensis* culture using supernatant of three different concentrations of digested rotten potato (DRP)

Types of medium	Treatments	Replications	Amounts of rotten potato (%)	Duration of culture (days)
Supernatant of DRP	T_1	3 (101,102 and 103)	20	14
	T_2	3 (201, 202, 203)	40	
	T_3	3 (301, 302, 303)	60	
Kosaric medium	T_4	3(KM-1, KM-2 and KM-3)	-	

For the preparation of Kosaric medium, the above-cited quantity (Table 2) of substances from no. 1 to 8 turned into weighed and took in a 1.0 L conical flask. Then 0.5 ml micronutrient answer became pipetted within the flask and distilled water changed into added to make the extent 1.0 L. blending, autoclaving and cooling were carried out pursuing the manner used all through the coaching of digested rotten potato media.

Culture of spirulina (*S. platensis*) in supernatant of DRP and KM

Four treatments, three from supernatant of digested rotten potato for three different concentrations (20, 40 and 60%) and one Kosaric medium (KM) as control each with three replications were used to grow microalgae, *S. platensis* in 1.0 L volumetric flask. Spirulina was inoculated into each culture flask to produce a culture containing 10% spirulina suspension (Optical density at 620 nm = 0.20) (Habib, 1998). Twenty ml of spirulina suspension needed for getting the required density. All the flasks were kept under fluorescent lights in light: dark (12h:12h) conditions in Live Food Culture laboratory.

These culture flasks were constantly aerated the usage of electric powered aerator. Four sub-sampling have been executed at each alternative day from every flask to document dry cellular weight and chlorophyll a content of spirulina, and houses of subculture media. All the glassware used inside the experiment becomes sterilized with dry heat at 70^{o}C overnight.

Estimation of cell weight (dry weight) of spirulina (Clesceri *et al.*, 1989)

Sample containing 20 ml spirulina suspension was filtered through a Sartorius filter paper of mesh size 0.45 µm and diameter 47 mm. The filter papers were dried in an oven for 24 hours or overnight at 70°C and weighed prior to filtration. The filtered samples were washed three times to remove insoluble salts.

Table 2. Composition of Kosaric medium (Modified after Zarrouk, 1996) for *Spirulina platensis* culture

SL. No.	Chemicals/ compounds	Concentration in stock solution g/L
1.	$NaHCO_3$	9.0
2.	K_2HPO_4	0.250
3.	$NaNO_3$	1.250
4.	K_2SO_4	0.50
5.	NaCl	0.50
6.	$MgSO4.7H_2O$	0.10
7.	$CaCl_2$	0.02
8.	$FeSO_4.2H_2O$	0.005
9.	A_5 micronutrient solution[a]	0.5ml/L
	a) A_5 micronutrient solution	G/L
	i) H_3BO_4	2.86
	ii) $MnCl2.4H_2O$	1.81
	iii) $ZnSO_4.7H_2O$	0.22
	iv) $CuSO_4.5H_2O$	0.08
	v) MoO_3	0.01
	vi) $CoCl_2.6H_2O$	0.01

After that the filter papers had been installed a glass petridish and stored within the oven at 70°C over night time. For cooling, petridish have been positioned into desiccator for 20 minutes and then clear out paper became weighed. The dry weight of algae on the clear out paper turned into measured using the subsequent equation:

Dry weight (mg/L), $$W = \frac{FFW - IFW}{\text{Amount of sample taken for filtration (ml)}} \times 100$$

Where,

W = Cell dry weight in mg/L;

FFW = Final filter paper weight in g; and

IFW = Initial filter paper weight in g.

Estimation of chlorophyll a of spirulina (Clesceri *et al.*, 1989)

The samples of *S. platensis* were collected in different times and chlorophyll a content of *S. platensis* was estimated. Ten ml of *S. platensis* sample was filtered with an electric filtration unit using filter papers (Sartorius filter paper of 0.45 µm mesh size and 47 mm). These filtered samples together with filter paper were taken into check tube and floor with glass rod and ultimately blended with 10 ml of 100% redistilled acetone. Every of the take a look at tubes turned into wrapped with aluminum foil paper to inhibit the touch of mild. The wrapped test tubes were kept right into a refrigerator overnight. Then the refrigerated sample was homogenized for 2 minutes followed by centrifugation at 4000 rpm for 10 minutes. After centrifugation the supernatant was isolated and taken for chlorophyll a determination. Optical densities of the samples were determined at 664 nm, 647 nm and 630 nm by using UV spectrophotometer (Clesceri *et al.*, 1989). A blank with 100% acetone was run simultaneously. Chlorophyll a content was calculated by the following formula:

Chlorophyll a (mg/L) = 11.85 (OD 664) – 1.54 (OD 647) – 0.08 (OD 630)

Total biomass of spirulina (*S. platensis*)

Total biomass was calculated using the following formula given by Vonshak and Richmond (1988):

Total biomass = Chlorophyll a x 67

Specific growth rate (SGR) on the basis of dry weight, chlorophyll a content and total biomass of spirulina (Clesceri *et al.*, 1989)

Specific growth rate (µ/day) of cultured spirulina on the basis of dry weight

SGR (µ/day) = In $(X_1-X_2)/t_1-t_2$

Where,

X_1 = Dry weight of biomass concentration of the end of selected time interval;

X_2 = Dry weight biomass concentration at beginning of selected time interval; and

t_1-t_2 =Elapsed time between selected time in the day.

Specific growth rate (µ/day) of cultured spirulina on the basis of chlorophyll a

SGR (µ/day) = In $(X_1-X_2)/t_1-t_2$

Where,

X_1 = Chlorophyll a at the end of selected time interval;

X_2 = Chlorophyll a at the beginning of selected time interval; and

t_1-t_2 = Elapsed time between selected time in the day.

Specific growth rate (µ/day) of cultured spirulina on the basis of total biomass

SGR (µ/day) = In $(X_1-X_2)/t_1-t_2$

Where,

X_1 = Total biomass at the end of selected time interval;

X_2 = Total biomass at the beginning of selected time interval; and

t_1-t_2 = Elapsed time between selected time in the day.

Statistical analysis

Analysis of variance (ANOVA) of imply cell weight and chlorophyll a of *S. platensis* cultured in exclusive media had been carried out. To locate where there's any great distinction among treatment means turned into performed by means of Duncan's multiple range take a look at (DMRT) the usage of statistical bundle following Zar (1984).

(a) (b)

Plate 1. (a) Suppling aeration for potato digestion in SEBO248A aquarium pump with continuous electricity, (b) Potato juice after filtration.

Plate 2. Preparing solutions with potato juice, urea, micro-nutrient and sodium bicarbonate.

Results

Growth parameters of spirulina (*S. platensis*)

Optical density of media contained spirulina

Optical density (OD) of media contained spirulina was discovered to elevated as much as 10th day of culture of all of the media of digested rotten potato media (DRPM) and Kosaric medium and then reduced up to 14th day of experiment (Figure 1). However, OD of 20% DRPM contained spirulina was 0.947 ± 0.12 g/L (Figure 1), where highest OD of 40% DRPM contained spirulina was found 0.565±0.103 (Figure 1). The OD of supernatant of 60% DRPM contained spirulina was 0.387 ± 0.062 g/L (Figure 1). The highest optical density of Kosaric medium contained spirulina was 2.61 ± 0.22 g/L (Figure 1).

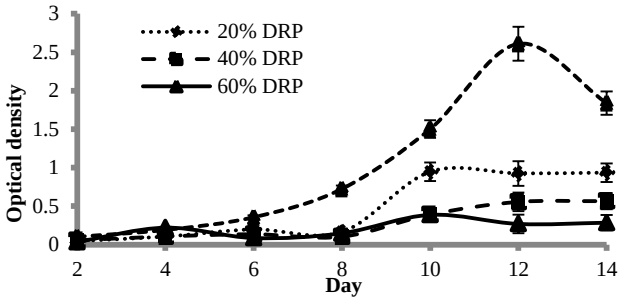

Figure 1. Mean values of optical density of media contained *Spirulina platensis* in supernatant of three different digested rotten potato, and Kosaric medium. Vertical bars represent standard errors.

Cell weight of spirulina

Cell weight (mg/L) of spirulina cultured in all the media was found higher on 12th day of culture than other days (Figure 2). Cell weight of spirulina increased from initial day (first day) up to 10th day (0.002 ± 0 mg/L) of culture of 20% digested rotten potato media (DRPM) and then decreased up to 12th day (6.256 ± 2.34 mg/L) of experiment (Figure 2). However, the highest cell weight of spirulina was found to be 8.352 ± 0.21 mg/L when grown in 40% DRPM (Figure 2). Cell weight of spirulina increased from initial day (first day) up to 12th day (9.505 ± 0.43 mg/L) of culture of 60% DRPM and then decreased up to 14th day 5.554 ± 0.45 mg/L of experiment (Figure 2). Highest cell weight of Kosaric medium contained spirulina was 12.42 ± 0.21 mg/L on 12th day and then decreased up to 14th day of experiment (Figure 2).

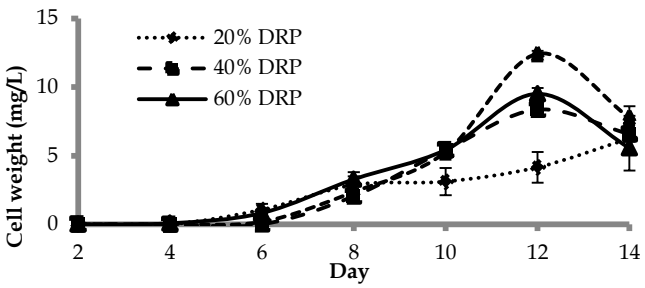

Figure 2. Mean values of cell weight (mg/L) of *Spirulina platensis* grown in supernatant of three different digested rotten potato, and Kosaric medium. Vertical bars represent standard errors.

Chlorophyll a of spirulina

Chlorophyll a of spirulina was found also higher on 12th day of culture than other days of culture of all the media (Figure

3). Chlorophyll a of spirulina increased from first day up to 4th day (5.14 ± 0.063 mg/L) of culture of 20% digested rotten potato media (DRPM) and then decreased up to 14th day (0.14 ± 0 mg/L) of experiment (Figure 3). However, chlorophyll a of spirulina cultured in 40% DRPM was 6.072 ± 0.004 mg/L on 6th day (Figure 3) and then decreased up to 10th day of culture. Chlorophyll a of spirulina grown in 60% DRPM was 1.605 ± 0.053 mg/L on 4th day and then decreased to 2nd day of experiment (Figure 3), where the highest chlorophyll a of spirulina cultured in Kosaric medium was 10.53 ± 0.15 mg/L on 10th day and decreased up to 14th day (last day) of experiment (Figure 3).

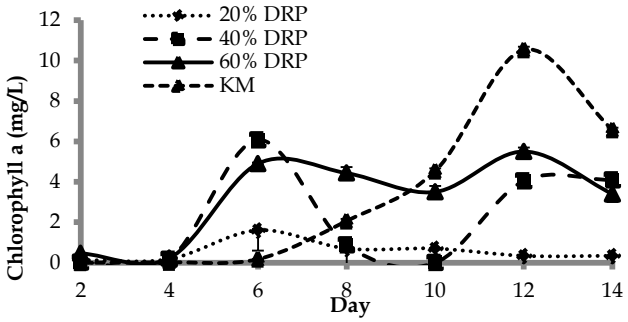

Figure 3. Mean values of chlorophyll a (mg/L) of *Spirulina platensis* grown in supernatant of three different digested rotten potato, and Kosaric medium. Vertical bars represent standard errors.

Total biomass of spirulina

Total biomass (mg/L) of spirulina (*S. platensis*) grown in all the media was found to be higher on 10th day of culture than other days of experiment (Figure 4). Total biomass of spirulina was increased from initial day (first day) up to 12th day (344.38 ± 6.02 mg/L) in the culture of 20% digested rotten potato media (DRPM) and then decreased up to 14th day (9.38 ± 0.1 mg/L) of experiment (Figure 4). However, the highest total biomass of spirulina grown in the culture of 40% DRPM was recorded 406.82 ± 0.40 mg/L on 6th day of culture and then decreased up to 10th day (0 ± 0.00 mg/L) during the experiment (Figure 4). Again, total biomass of spirulina cultured in the culture of 60% DRPM was increased from first day up to 4th day (107.53± 3.56 mg/L) and then decreased up to 12th day (22.91 ± 3.30 mg/L) of experiment (Figure 4). The highest total biomass of spirulina cultured in Kosaric medium was found to be 705.51 ± 9.45 mg/L on 14th day and then increased up to 12th day (440.19 ± 4.42 mg/L) during experiment (Figure 4).

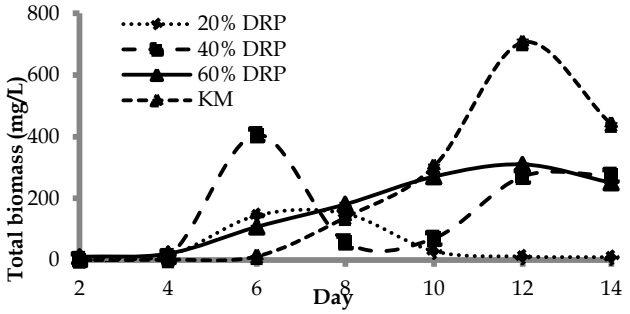

Figure 4. Mean values of total biomass (mg/L) of *Spirulina platensis* grown in supernatant of three different digested rotten potato, and Kosaric medium. Vertical bars represent standard errors.

Comparison of growth parameters of spirulina (*Spirulina platensis*) of 10th day of culture

Optical density of media contained spirulina

Optical density of supernatant of 40% digested rotten potato (DRPM) and Kosaric medium contained spirulina (*S. platensis*) was significantly ($p < 0.01$) higher than that of two other media (20% DRPM) and (60% DRPM) (Table 3). There was no significant ($p > 0.05$) difference among optical density of 20% DRPM and Kosaric medium, and among 40% and 60% DRPM during the study.

Cell weight of spirulina

Highest cell weight (mg/L) of spirulina grown in Kosaric medium was recorded (Table 3). Cell weight of spirulina grown in Kosaric medium and supernatant of 40% DRPM was varied significantly ($p < 0.01$) from that cultured in supernatant of 20% and 60% DRPM (Table 3). However, there was no significant ($p > 0.01$) difference of cell weight of spirulina grown in 20% and 60% DRPM.

Chlorophyll a of spirulina

Chlorophyll a (mg/L) of spirulina grown in Kosaric medium and supernatant of 40% digested rotten potato (DRPM) was significantly ($p < 0.01$) higher than that of spirulina cultured in 20% and 60% DRPM (Table 3). There was no significant difference among the Chlorophyll a of spirulina grown in Kosaric medium and supernatant of 40% DRPM, and among the same of spirulina cultured in supernatant of 20% and 60% DRPM.

Total biomass of spirulina (*S. platensis*)

Total biomass (mg/L) of spirulina cultured in Kosaric medium and supernatant of 40% DRPM was significantly ($p < 0.01$) higher than that of spirulina grown in supernatant of 20% and 60% DRPM (Table 3). There was no significant difference found among the total biomass of spirulina cultured in supernatant of 20% and 60% DRPM. The culture of spirulina in supernatant of digested rotten potato in 2.0 L flasks is presented in Plate 1(b), and culture in 4.0 L flasks on 10th day of experiment.

Table 3. Comparison of cell weight, chlorophyll a and total biomass of *Spirulina platensis* grown in supernatant of different digested rotten potato (DRP), and Kosaric medium on 10th day of culture before stationary phase

Parameters	T_1 (20% DRP)	T_2 (40% DRP)	T_3 (60% DRP)	T_4 (KM)
Optical density	1.40 ± 0.12^b	2.35 ± 0.15^a	1.50 ± 0.13^b	2.65 ± 0.22^a
Cell weight (mg/L)	7.9 ± 0.20^b	11.50 ± 0.55^a	9.50 ± 0.45^b	12.50 ± 0.21^a
Chlorophyll a (mg/L)	7.35 ± 0.12^b	10.50 ± 0.35^a	7.50 ± 0.20^b	10.60 ± 0.16^a
Total biomass (mg/L)*	460.05 ± 8.15^c	675.05 ± 9.32^b	490.79 ± 8.33^c	700.50 ± 9.50^a

*Total biomass = Chlorophyll a x 67 (Vonshak and Richmond, 1988).Figures in common letters do not differ significantly at 5% level of probability.

Correlation among the growth parameters of spirulina

Cell weight of spirulina (*S. platensis*) had highly significant ($p < 0.01$) direct correlation with chlorophyll a ($r = 0.993$) of spirulina grown in the supernatant of different digested rotten media and Kosaric medium during the study (Figure 5).

Similarly, total biomass of *S. platensis* was highly ($p < 0.01$) and directly correlated with chlorophyll a ($r = 0.989$) of spirulina cultured in the supernatant of various digested rotten potato and Kosaric medium (Figure 6). Again, total biomass of spirulina was found to be highly ($p < 0.01$) and directly correlated with the cell weight ($r = 0.925$) of spirulina grown in the supernatant of different digested rotten potato and Kosaric medium (Figure 7).

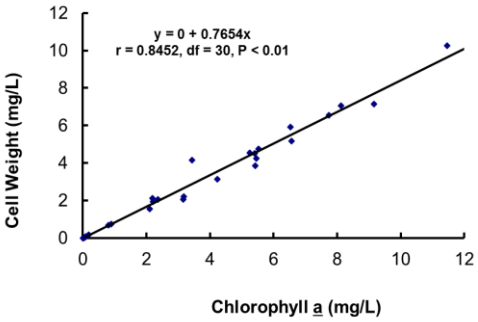

Figure 5. Correlation coefficient (r) of cell weight (mg/L) of *Spirulina platensis* with chlorophyll a (mg/L) of spirulina grown in supernatant of three digested liquid rice starch media and Kosaric medium.

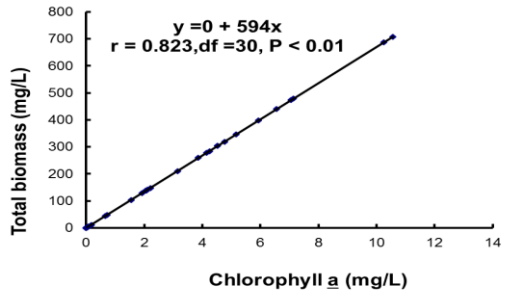

Figure 6. Correlation coefficient (r) of total biomass (mg/L) of *Spirulina platensis* with chlorophyll a (mg/L) of Spirulina grown in supernatant of three digested liquid rice starch media and Kosaric medium.

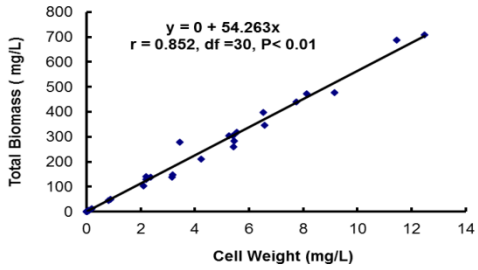

Figure 7. Correlation coefficient (r) of total biomass (mg/L) of *Spirulina platensis* with cell weight (mg/L) of spirulina grown in supernatant of three digested liquid starch media and Kosaric medium.

Specific growth rates (SGRs) of spirulina (*S. platensis*)

SGR in respect to cell weight of sprulina

Specific growth rate (SGR) in respect to cell weight of spirulina grown in Kosaric medium and supernatant of 40% digested rotten potato media (DRPM) was significantly ($p < 0.01$) higher than that of spirulina cultured in the supernatant of 20% and 60% DRPM (Table 4). There was no significant ($p > 0.01$) difference among the SGR of cell weight of spirulina grown in Kosaric medium and supernatant of 40% DRPM, and among the same of spirulina cultured in the supernatant of 20% and 60% DRPM.

SGR in respect to Chlorophyll a of spirulina (*S. platensis*)

The SGR in respect to Chlorophyll a of spirulina cultured in Kosaric medium and supernatant of 40% digested rotten potato media (DRPM) was significantly ($p < 0.01$) varied from that of spirulina grown in the supernatant of 20% and 60% DRPM (Table 4). It had no significant difference when spirulina grown in Kosaric medium and supernatant of 40% DRPM, and similar thing happened when spirulina cultured in the supernatant of 20% and 60% DRPM.

SGR in respect to total biomass of spirulina

The SGR in respect to total biomass of spirulina cultured in Kosaric medium and supernatant of 40% digested rotten potato media (DRPM) was significantly ($P < 0.01$) varied from that of spirulina grown in the supernatant of 20% and 60% DRPM (Table 4). There was no significant ($p < 0.01$) difference recorded among the SGRs on the basis of total biomass of *S. platensis* grown in the supernatant of 40% DRPM and Kosaric medium. Similarly, it had no significant variation among the SGR on the basis of total biomass of spirulina when cultured in the supernatant of 20% and 60% DRPM.

Table 4. Specific growth rates (SGRs) on the basis of cell weight, chlorophyll a and total biomass of *Spirulina platensis* grown in supernatant of different digested rotten potato media (DRPM), and Kosaric medium

Parameters	T_1 (20% DRPM)	T_2 (40% DRPM)	T_3 (60% DRPM)	T_4 (KM)
SGR of cell weight	0.26 ± 0.021^b	0.30 ± 0.022^a	0.27 ± 0.014^b	0.31 ± 0.021^a
SGR of Chlorophyll a	0.24 ± 0.012^b	0.28 ± 0.014^a	0.25 ± 0.011^b	0.29 ± 0.014^a
SGR of total biomass	0.75 ± 0.033^b	0.80 ± 0.026^a	0.76 ± 0.020^b	0.81 ± 0.023^a

N.B. Figures in common letters in the same row do not differ significantly at 5% level of probability.

Discussion

S. platensis was cultured in three different concentrations (20, 40 and 60%) of supernatant of digested rotten potato and KM as control. The cell weight of *S. platensis* in supernatant of digested rotten potato were found 0.002 to 6.2 mg/L in 20% digested rotten potato media (DRPM), 0.0016 to 8.352 g/L in 40% DRPM, 0.0022 to 9.505 mg/L in 60% DRPM and 0.0023 to 12.42 mg/L in KM. The growth performance of *S. platensis* in supernatant of 40% DRPM was found better than 20% and 60% DRPM. This transformation might be because of the differences in nutrient concentrations and composition of varied media. In controlled KM *S. platensis* confirmed the very best boom overall performance. It may be befallen because of suitability and availability of the vitamins for the boom of the species. On the other hand 20% DRPM showed lower growth performance of *S. platensis* in relation to 40% and 60% DRPM. This might be due to higher dilution and lower concentration of the nutrients in the media. The concentration of 40% and 60% DRPM which are suitable and favorable for the growth of *S. platensis* because of the nutrient content. The comparative observe of growth

performance *S. platensis* in one of a kind attention of the media suggests better dilution followed lower awareness of nutrients and lower growth overall performance. During culture of *S. platensis*, the exponential phase was found up to 10th day from the beginning and then the cell weight declined i.e. stationary phase started. During the culture system the climate condition was more or less suitable and less suitable and favorable for the growth of *S. platensis*. Satter (2017) recorded the cell weight and chlorophyll a content of *S. platensis* was significant ($p < 0.05$) higher in 4.0 g/L digested poultry waste than other media where light intensity, aeration and temperature played significant role to the culture system. Similarly, Dey (2004) found that *S. platensis* grown in mustard oil cake medium in the concentration of 3.0, 4.0, 0.5 mg/L and KM. The maximum growth was 451.0, 614.33, 403.4 and 719.0 mg/L, respectively. These findings are more or less similar to the present findings. These present findings are more or less similar with the findings of Khan (2003) and Habib (1998).

In the present study, the initial cell weight was 0.0022 mg/L which attained a maximum cell weight of 12.42 mg/L which grown in KM and 6.256 mg/L in 20% DRPM, 8.352 mg/L in 40% DRPM, 9.505 mg/L in 60% DRPM on the 10th day of the culture. The chlorophyll a content of inoculated *S. platensis* was 0.0015 mg/L which attained a high content of 10.53 mg/L which cultured in KM and 6.072 mg/L in 40% DRPM at the 12th day of culture. These findings are more or less similar with the findings of Phang *et al.* (2000), Habib *et al*. (2003), Satter (2017) and Habib *et al*. (2019). In the present study, supernatant of digested rotten potato was used as a media of three concentrations for the culture of *S. platensis.* The supernatant of 60% digested rotten potato showed maximum optical density on the 10th day of culture comparing with KM which has the similarity with the findings of Habib *et al.* (1997, 2003), Satter (2017).

Conclusion

This research was performed on culture and growth performance of *S. platensis* in different concentration of supernatant of digested rotten potato, and KM in which growth is highest. *S. platensis* was cultured in supernatant of various concentration viz., 20, 40 and 60% digested rotten potato, and KM with three replications for each treatment under fluorescent light in light: dark (12hr: 12hr) condition for period of 14th days. Rotten potato may be used to grow spirulina due to presence of organic carbon as carbohydrate in potato. Spirulina grows well in supernatant of 60% digested rotten potato which is equivalent to the growth of spirulina in Kosaric medium. So, the supernatant of 60% digested rotten potato should be used to grow spirulina. Environment may be free from pollution due to use of rotten potato. So, there is a huge chance of large scale rotten potato may be used to commercial culture of spirulina and marketed as live food for the good production and management of fish health.

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