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Subacute dermal toxicity of *Thermomyces* sp. and *Penicillium purpurogenum* pigments in wistar rats

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Abstract
This research was focused to evaluate the dermal toxicity of yellow and red pigment isolated from *Thermomyces* sp. and *Penicillium purpurogenum* for textile application to assess its safety in experimental animals. Acute and sub-acute dermal toxicity studies were conducted on both sexes of wistar rats. Dermal application of *Thermomyces* sp and *P purpurogenum* at 0.5-5.0g/kg body weight to adult rat did not show any symptoms of toxicity or mortality of the rat. Dermal application of *Thermomyces* sp and *Penicillium purpurogenum* at 0.75-2.5% level (w/w) for 28 days did not produce any significant changes in body weight gain of the experimental rat compared to control rat. There were no significant differences in the relative weight of vital organs, hematological parameters and histopathological analysis between the experimental and control groups. The results clearly showed that acute and sub-acute dermal application of fungal pigment did not produce any toxic effects in male and female rats.

Keywords: dermal toxicity, fungal pigment, *Penicillium purpurogenum,* textile application, *Thermomyces* sp

Introduction
Natural colourants are considered to be safer than synthetic ones and their applications in foods, textile, cosmetics and pharmaceuticals are growing rapidly. There are a number of natural pigments, but only a few are available in sufficient quantities for industrial production. The pigments from microbial sources are a good alternative that could easily be produced in high yields and capability of producing different coloured pigments. Pigment producing microorganisms and microalgae are quite common in nature which includes carotenoids, melanins, flavins, quinones and more specifically monascins, violacein, phycocyanin or indigo. Production of pigments from microorganisms is advantageous over other sources because microorganisms can grow rapidly which may lead to a high productivity of the product (Mapari *et al,* (2009) [8] and 2010 [9].

Microbial pigments are eco-friendly colorants applicable to dyeing textile fabrics (Chadni *et al,* (2017) [2]. Many microbial pigments were used to dye different types of fabric. Prodigiosin from *Vibrio* spp. can dye wool, nylon, acrylics, and silk. By using tamarind as a mordant, pigment from *Serratia marcescens* can color up to five types of fabric, including acrylic, polyester microfiber, polyester, silk, and cotton (Yusof, (2008) [17]. Anthraquinone from *Fusarium oxysporum* can be used to dye wool fabrics (Nagia and El-Mohamedy, (2007) [10]. Recently, Sudha, Gupta and Aggarwal (2016) [15] reported dyeing of wet blue goat nappa skin with the *Penicillium minioluteum* pigment. A red pigment from *Talaromyces verruculosus* shows an adequate color tone for cotton fabric without any cytotoxic effect (Chadni *et al.,* (2017) [2].

This study examines the use of this yellow and red pigment extract in topical applications. Both acute and sub-acute dermal toxicity studies are performed. Acute toxicity is measured using a single large dose to determine both immediate toxic effects and sub-acute toxicity test uses sub-lethal doses over 30 days to determine the no observed adverse effect level (Lipnick *et al.,* (1995) [6].

Materials
Growth and culture conditions
A loop full of *Thermomyces* sp and *Penicillium purpurogenum* from the PDA slants was inoculated into 10 ml of broth. After 2 or 3 days of growth the inoculum was transferred to 3 lit and 5 lit flasks containing the potato dextrose medium.

The extracellular pigments that are excreted in the broth after 5 days of growth were harvested by filtration using Whatman No 1 filter paper. The culture extract was concentrated using vacuum rotary evaporator. The concentrated solutions were then lyophilized to get the dryness and stored at -20ºC until they were utilized for assays.

Experimental animals and housing conditions

Young male and female rat (approximately 150 g) were employed for the sub-acute dermal toxicity studies. The animals were obtained from the KMCH College and Pharmacy and maintained in Institute Animal House Facility. The Institute is recognized for animal studies by the ethical committee. The animals were acclimatized for approximately one week and assigned to five groups, all consisting of 7 animals of each group. The animals were housed in polycarbonate cages (seven rat /cage) on soft chip bedding, which was changed twice per week. For drinking water, tap water was provided. They were housed in a room maintained at 25 ± 2 ºC with a relative humidity of 60–70% and exposed to a light and dark cycle of 12 h duration.

Animal experiments were carried out based on the ethical guidelines laid down by the committee for the purpose of control and supervision of experiments on animals by the Government of India, Ministry of Social Justice and Empowerment.

Diet

Rat were fed with commercial diet (Ms / Amrut – laboratory animal feed, Pranav agro industrial Ltd) obtained from Banagalore. The pigment was orally administered at levels based on body weight sub-acute toxicity studies. The animals were observed daily for signs of adverse effects and were weighed at the start and on weekly intervals for 5 weeks.

Dermal Acute toxicity study

Five adult male and female rats were randomly divided into three groups with five animals in each group. A graded dose of *Thermomyces* sp and *Penicillium purpurogenum* was applied through of 1.0, 2.5 and 5.0 g/kg body weight on day one only. Prior to dosing, rats were fasted overnight. Rats were observed thoroughly for onset of any immediate toxic signs and also during the observation period of 1 week for any delayed acute effects. The following general behaviors were observed for first 1h and after 24 h of test drug administration *viz.,* motor activity, tremors, convulsions, straub reaction, aggressiveness, pilo-erection, loss of lighting reflex, sedation, muscle relaxation, hypnosis, analgesia, ptosis, lacrimation, diarrhea and skin colour.

Dermal Sub acute toxicity study

The both sexes of rat were randomly assigned to control and treatment groups. The rat were fed with 0 %, 0.25 %, 1 % and 2 % extracellular pigment through orally to assess the cumulative effect of low doses of pigment. Body weight gain was monitored and all the animals were observed thoroughly for the onset of any toxicity. At the end of the experimental period all the animals were killed humanely under light ether anesthesia.

Organ weight and histopathological studies

The following vital organs of each rats such as liver, kidney, heart, spleen and lungs were excised and weighed. Histopathological investigation of skin experimental and control rat were performed after sacrificing them at the end of 28 days of drug administration. These tissues were separately sliced in pieces, fixed in 10 % formaline for 3 days; processed; stained using hematoxylin, eosin reagent and diphenyl xylene mounting fluid; mounted on glass slides and observed under power microscope.

Hematological study

Blood samples were collected from at least 3 rat of each group and were examined for haemoglobin concentration, red blood cells, white blood cells and other hematological parameters.

Results

Toxicity analysis of fungal pigments from *Thermomyces* sp

The toxicity study for 28 days conducted for assessing the safety evaluation of pigment of *Thermomyces* sp. by acute and short term sub-acute toxicity in Wistar rat.

Clinical signs

All the rat were observed at least twice daily with the purpose of recording any symptoms of ill-health or behavioral changes. These observations were also performed on week-ends. The observations included changes in skin and fur, in the eyes and mucous membranes, in the respiratory, circulatory, central nervous and autonomous systems, somatomotor activity and behavior.

All the rat survived until scheduled necropsy and showed normal growth and appeared healthy throughout the study. Daily general observations, opthalmoscopy and clinical examinations revealed no treatment – related changes (data not shown).

Body weight

The bodyweight of each rat were recorded before the start of the treatment and the changes of body weight recorded every week. In general oral dose of fungal pigment at 2% level did not significantly affect the food intake in both sexes of treatment groups (data not shown). The changes of body weight in both sexes were slightly increased. The body weight of both sexes exposed to 2% tends to be higher than the control values. The mean weights for different groups and sexes were calculated from the individual weights (Table 1).

Organ weight

There was no significant difference in the group mean relative weight of various vital organs (kidney, liver, pancreas, lungs and heart) in the pigment treated rat compared to that of control group (Table 2).

Hematological profile

Red blood cells, white blood cell and haemoglobin did not show any biologically or statistically significant differences between control and treatment groups. Data on the various hematological parameters are presented in Table 3.

Histopathological examinations

Gross examinations of vital organs during autopsy did not reveal any abnormalities that could be attributed to oral dose of *Thermomyces* sp., in both sexes of rat. Further on microscopic examination, no treatment related histopathological alterations were observed in any of the vital organs. Detailed histopathological examinations of each vital

organ are shown in Table 4. Liver was characterized by normal hepatic tissue with distinct nuclei and normal eosinophilic cytoplasm with normal sinusoids. Kidney displayed normal renal parenchyma with normal glomerules, proximal tubules and collecting ducts.

Table 1: Body weight of Wistar rat fed with *Thermomyces* sp and *Penicillium purpurogenum* pigment for 28 days

Animals	Days of study				
	0	7	14	21	28
Male concentration (g/kg b.w)					
Control	124 ± 2.8	124 ± 2.8	124 ± 2.8	124 ± 2.8	124 ± 2.8
0.75 % Yellow pigment	125 ± 2.8	125 ± 2.8	125 ± 2.8	125 ± 2.8	125 ± 2.8
1.25 % Yellow pigment	110 ± 2.5	110 ± 2.5	110 ± 2.5	110 ± 2.5	110 ± 2.5
2.5 % Yellow pigment	134 ± 3.09	134 ± 3.09	134 ± 3.09	134 ± 3.09	134 ± 3.09
0.75 % Red pigment	159 ± 3.6	159 ± 3.6	159 ± 3.6	159 ± 3.6	159 ± 3.6
1.25 % Red pigment	112 ± 2.5	112 ± 2.5	112 ± 2.5	112 ± 2.5	112 ± 2.5
2.5 % Red pigment	129 ± 2.9	129 ± 2.9	129 ± 2.9	129 ± 2.9	129 ± 2.9
Female concentration (g/kg b.w)					
Control	115 ± 1.7	124 ± 2.8	124 ± 2.8	124 ± 2.8	124 ± 2.8
0.75 % Yellow pigment	126 ± 7.02	125 ± 2.8	125 ± 2.8	125 ± 2.8	125 ± 2.8
1.25 % Yellow pigment	95 ± 2.64	110 ± 2.5	110 ± 2.5	110 ± 2.5	110 ± 2.5
2.5 % Yellow pigment	152 ± 1.2	134 ± 3.09	134 ± 3.09	134 ± 3.09	134 ± 3.09
0.75 % Red pigment	114 ± 2.4	159 ± 3.6	159 ± 3.6	159 ± 3.6	159 ± 3.6
1.25 % Red pigment	111 ± 2.5	112 ± 2.5	112 ± 2.5	112 ± 2.5	112 ± 2.5
2.5 % Red pigment	122 ± 0.88	129 ± 2.9	129 ± 2.9	129 ± 2.9	129 ± 2.9

Data are mean ± SD of three measurements. $P< 0.05$ compared to control

Table 2: Relative organ weight of rat fed with *Thermomyces* sp and *Penicillium purpurogenum* pigment

S. No	Experimental group	Relative organ weights (g/ animal)					
		Kidney (L)	Kidney (R)	Liver	Lungs	Heart	Spleen
Male							
1	Control	0.580± 0.01	0.64 ± 0.01	6.12 ± 0.01	1.41± 0.01	0.61± 0.01	0.85 ± 0.01
2	0.75 % Yellow pigment	0.61± 0.03	0.68 ± 0.02	5.89 ± 0.01	2.14 ± 0.01	0.58 ± 0.01	0.91 ± 0.01
3	1.25 % Yellow pigment	0.58± 0.02	0.75 ± 0.04	5.12± 0.02	1.54 ± 0.01	0.7 ± 0.01	0.87 ± 0.02
4	2.5 % Yellow pigment	0.64± 0.03	0.58 ± 0.02	5.09± 0.02	1.78 ± 0.01	0.75 ± 0.01	0.75 ± 0.02
5	0.75 % Red pigment	0.68 ± 0.01	0.7 ± 0.02	6.04 ± 0.02	2.05 ± 0.01	0.78 ± 0.01	1.12 ± 0.02
6	1.25 % Red pigment	0.45 ± 0.01	0.68 ± 0.04	5.45 ± 0.04	1.94 ± 0.01	0.63 ± 0.01	0.89 ± 0.02
7	2.5 % Red pigment	0.69 ± 0.01	0.67 ± 0.04	5.36 ± 0.03	1.69 ± 0.01	0.75± 0.01	1.23 ± 0.02
Female							
1	Control	0.70± 0.05	0.76± 0.04	5.7± 0.03	1.35 ± 0.38	0.56 ± 0.1	0.86 ± 0.02
2	0.75 % Yellow pigment	0.59± 0.03	0.61± 0.04	4.7± 0.24	1.54 ± 0.15	0.63 ± 0.03	0.99 ± 0.02
3	1.25 % Yellow pigment	0.56± 0.02	0.61± 0.02	4.9± 0.27	1.34 ± 0.03	0.66 ± 0.03	0.9 ± 0.02
4	2.5 % Yellow pigment	0.66± 0.03	0.68± 0.04	5.3± 0. 5	1.94 ± 0.11	0.78 ± 0.08	0.7 ± 0.04
5	0.75 % Red pigment	0.60 ± 0.04	0.58± 0.08	4.4 ± 0.05	1.44 ± 0.11	0.51 ± 0.12	0.8 ± 0.04
6	1.25 % Red pigment	0.6 ± 0.03	0.58± 0.02	5.3 ± 0.18	1.98 ± 0.29	0.53 ± 0.06	0.9 ± 0.04
7	2.5 % Red pigment	0.60 ± 0.02	0.61± 0.02	4.7 ± 0.13	1.71 ± 0.17	0.65± 0.03	0.7 ± 0.04

Data are mean ± SD of three measurements. $P< 0.05$ compared to control

Table 3: Hematological profile of rat fed with *Penicillium purpurogenum* pigment

Animals	RBC (10^6/µl)	HB (g/dl)	PCV (l/l)	MCV (fi)	MCH (pg)	MCHC (g/di)	PLT (10^3/ µl)	RDW (%)	MPV (fL)	WBC (10^3/µl)	P (%)	L (%)	M (%)
Male concentration (g/kg b.w)													
Control	6.7± 0.15	15.67 ± 0.62	43.13 ± 0.9	64.11 ± 1.49	23.34 ± 0.5	36± 0.8	864 ± 19	19.16 ± 0.4	8.12 ± 0.18	13.21 ± 0.3	1.6 ± 0.03	89.7 ± 2.02	2.15 ± 0.04
0.75 % Red pigment	6.8 ± 0.15	14.98± 0.59	41.23± 0.94	62.42± 1.43	19 ± 0.4	32± 0.74	841± 19	19.6 ± 0.4	8.67 ± 0.2	11.23 ± 0.25	1.0 ± 0.02	95.47 ± 2.2	0.87± 0.02
1.25 % Red pigment	7.1 ± 0.16	13.02± 0.25	46.76 ± 1.06	62.86 ± 1.43	21.56 ± 0.4	33± 0.78	821 ± 18.96	18.6 ± 0.4	7.78± 0.17	10.54 ± 0.24	1.9± 0.04	92.58 ± 2.13	0.78± 0.01
2.5 % Red pigment	7.2 ± 0.16	14.6±0.52	43.21± 1.1	63.7 ± 1.4	20.4 ± 0.4	33± 0.7	835 ± 19.24	17.2 ± 0.38	7.81 ± 0.18	12.36 ± 0.28	1.7 ± 0.03	96.44± 2.2	1.24 ± 0.02
Female concentration (g/kg b.w)													
Control	6.9± 0.5	14.3 ± 0.1	46.1 ± 1.18	67.13 ± 7.49	20.83 ± 1.57	31± 1	839 ± 35	16.7 ± 1.1	8.5 ± 0.4	6.19 ± 0.6	1.3 ± 0.58	89.7 ± 11.02	2.0 ± 1.0
0.75 % Red pigment	7.3 ± 0.3	14.57± 0.7	46.23± 2.3	66.30± 1.7	19.83 ± 1.8	31.47± 0.7	802 ± 38	18.2 ± 1.05	8.10 ± 0.8	11.57 ± 6.4	1.0 ± 0.1	98.0 ± 0.00	0.33± 0.58
1.25 % Red pigment	6.4± 0.08	14± 0.35	45.47 ± 4.3	64.83 ± 0.8	20.83 ± 1.2	33.23± 2.2	804 ± 99.7	16.7 ± 1.6	9.77± 0.42	8.17 ± 3.76	1.7± 0.58	94.3 ± 2.08	2.33± 1.15
2.5 % Red pigment	7.5 ± 0.3	14.6±0.7	46.3± 1.8	66.3 ± 2	19.27 ± 0.55	31.4± 0.49	786 ± 36.91	18.9 ± 0.21	7.84 ± 0.31	12.73 ± 2.25	1.0± 0.1	98.0± 0.00	1.00 ± 1.00

Data are mean ± SD of three measurements; $P< 0.05$ compared to control

Table 4: Hematological profile of rat fed with *Thermomyces* sp pigment

Animals	RBC (10^6/µl)	HB (g/dl)	PCV (l/l)	MCV (fi)	MCH (pg)	MCHC (g/di)	PLT (10^3/ µl)	RDW (%)	MPV (fL)	WBC (10^3/µl)	P (%)	L(%)	M (%)
Male concentration (g/kg b.w)													
Control	6.7± 0.15	15.67 ± 0.62	43.13 ± 0.9	64.11 ± 1.49	23.34 ± 0.53	36.46± 0.84	864 ± 19.12	19.16 ± 0.44	8.12 ± 0.18	13.21 ±0.3	1.6 ± 0.03	89.7 ± 2.02	2.15 ± 0.04
0.75 % Yellow pigment	6.5 ± 0.15	13.78 ± 0.31	47.13 ± 1.08	63.43 ± 1.45	21.87 ± 0.50	32.0± 0.74	856 ± 19.76	19.65 ± 0.45	8.05 ± 0.18	12.47 ± 0.28	1.4 ± 0.03	88.9 ± 2.05	1.87 ± 0.04
1.25 % Yellow pigment	6.7 ± 0.15	14.25 ± 0.57	44.27 ±1.06	67.01 ± 1.54	21.98 ± 0.5	32± 0.74	849 ± 19.51	21.43± 0.49	7.89 ± 0.18	9.75 ± 0.22	1.2 ± 0.02	87.65 ± 2.02	2.45 ± 0.05
2.5 % Yellow pigment	6.5 ± 0.15	15.20 ± 0.632	46.21 ± 1.06	61.62 ± 1.4	19.45 ± 0.44	35.16± 0.81	832± 19.21	20.24 ± 0.46	8.31 ± 0.19	10.54 ± 0.24	1.5 ± 0.03	92.45 ± 2.13	1.87 ± 0.04
Female concentration (g/kg b.w)													
Control	6.9± 0.57	14.37± 0.15	46.13 ± 1.18	67.13 ± 7.49	20.83 ± 1.57	31.13± 1.07	839 ± 35.16	16.73 ± 1.11	8.50 ± 0.40	6.19 ± 0.65	1.3 ± 0.58	89.7 ± 11.02	2.0 ± 1.0
0.75 % Yellow pigment	6.6 ± 0.68	13.70 ± 1.08	45.03 ± 2.57	66.77 ± 4.35	20.57 ± 0.57	33.33 ± 0.90	814 ± 35.22	16.60 ± 1.31	7.97 ± 0.32	10.80 ± 2.51	1.3 ± 0.58	96.3 ± 3.06	1.33 ± 1.53
1.25 % Yellow pigment	6.8 ± 0.91	14.00 ± 1.76	46.67 ± 2.35	67.03 ± 2.82	20.50 ± 1.45	33.37 ± 1.71	819 ± 64.53	16.63 ± 1.25	8.13 ± 0.72	6.37 ± 2.05	1.0 ± 0.00	95.3 ± 2.31	2.67 ± 1.53
2.5 % Yellow pigment	6.18 ± 0.77	14.20 ± 0.72	44.33 ± 4.04	64.63 ± 4.09	20.10 ± 1.61	33.67 ± 0.55	832± 65.11	22.03 ± 5.91	7.97 ± 0.99	7.30 ± 1.04	1.0 ± 0.00	96.0 ± 1.00	1.67 ± 0.58

Data are mean ± SD of three measurements; $P< 0.05$ compared to contro

Table 5: Serum enzymes and cholesterol of male rats

S. No.	Animals	SGOT (U l^{-1})	SGPT (U l^{-1})	Total protein	Urea (mg di^{-1})	Cholesterol (mg di^{-1})	Creatinine
1	Control	199 ±18	231 ± 48	16.73 ± 0.3	28.80 ± 8.7	115 ± 5.4	1.50 ± 0.3
2	0.75 % Yellow pigment	137 ± 4[b]	219 ± 63	15.00 ±1.1	35.85 ± 5.7	77.1 ± 5.7[c]	0.80 ± 0.1[a]
3	1.25 % Yellow pigment	166 ±3 [a]	165 ±13	19.20 ± 8.4	26.00 ± 6.3	91.7 ± 9.5	0.9 ± 0.1[a]
4	2.5 % Yellow pigment	153 ±7[a]	263 ±39	11.50 ± 1.7	32.55 ± 2.8	107 ± 13.5	1.2 ± 0.2
5	0.75 % Red pigment	178 ±17	411 ±26 [b]	12.10 ±0.9[c]	42.40 ± 6.6	87.35 ±3.8[c]	1.1 ± 0.3
6	1.25 % Red pigment	140 ± 12[b]	278 ±14	14.30 ± 0.9	27.25 ± 5.5	121 ± 14.8	1.4 ± 0.2
7	2.5 % Red pigment	127 ± 20[b]	234 ± 77	20.73 ± 8.9	30.15 ± 1.6	107 ±14.2	0.73 ± 0.07[b]

Data are mean ± SD of three measurements; $P< 0.05$ compared to control

SGOT – Serum glutamic oxaloacetic transaminase, SGPT- Serum glutamic pyruvic transaminase, Total protein References.

Discussion

Acute and sub -acute toxicity testing in laboratory animal are used to evaluate fungal pigment used as dye for colouring fabrics (Sasidharan *et al.,* (2008) [12]. It is one of the necessary studies need to be performed for the toxicological analyses of fungal pigments. The toxicity effects of the pigment are evaluated through qualitative and quantitative analyses of blood and histopathology samples of the laboratory animal (Sasidharan *et al*., (2008) [12]. Dermal Toxicology tests are used to evaluate products such as individual compounds, mixture of compounds, crude extract, medications, plant pigments and microbial pigments. Microbes are the dominant source to obtain a range of products *viz*., enzymes, aminoacids, vitamins, antibiotics, pigments and drugs. Therefore, such microbial pigments must be investigated for better understanding of their medicinal properties, safety and effectiveness. Bioactive products from medicinal plants tend to be used more often in self-medication due to being considered naturally safe (Kumar *et al.,* (2015) [5]; Joshi *et al*., (2013) [3]. However, this is a dangerous assumption, as there are many such plant compounds which are highly toxic, including the most cytotoxic anti-cancer plant- derived drugs, digitalis, the pyrrolizidine alkaloids, ephedrine, phorbol esters, and so on (Kim and Ku, (2018) [4].

Safety of *Thermomyces* sp. and *Penicillium purpurogenum* pigment was analyzed for acute and sub acute dermal toxicity, a prerequisite for textile application. In present study, no treatment related adverse effects were observed for any parameters in either sex of animals receiving up to 2.5 % level dermal application. The oral toxicity of Yellow pigment from Thermomyces sp. was found not inducing any toxic effects in albino mice and also well tolerated even at 2% level (Poorniammal *et al.,* (2011) [11].

Organ weight likewise is a vital record of physiological and obsessive status in creatures. The relative organ weight is major to finding, whether the organ was presented to the damage or not. The body weight gain of experimental animals and control group is an indicator of the degree of wellness and health of the rats.

Microbial pigments produce different color tones in different textiles. Pigment from *Janthinobacterium lividum* show a bluish purple color tone on silk, cotton, and wool, while dark blue is seen with nylon and vinylon (Shirata *et al.,* (2000) [14]. Microbial pigments serve as antimicrobial agents against a wide range of pathogens. Pigments such as carotenoids, melanins, flavins, quinones, monascins, violacein, and indigo have been reported as good antimicrobial agents (Malik *et al.*, (2012) [7]. Pigment obtained from *Streptomyces hygroscopic us*, even showed good antimicrobial activity against drug resistant pathogens such as methicillin and vancomycin resistant strains of *Staphylococcus aureus* and -lactamase producing strains of *Escherichia coli*, *Ps*eudomonas aeruginosa, and Klebsiella sp. (Vendruscolo, *et al.,* (2016) [16]; Selvameenal *et al*., (2009) [13]. Pigments such as anthraquinones, naphthaquinones, dihydroxy naphthalene melanin, flavin, anthraquinone, chrysophanol, cynodontin, helminthosporin, tritisporin, and erythroglaucin were reported by genera such as *Eurotium*, *Fusarium Curvularia* and *Drechslera* (Babitha, (2009) [1].

Conclusion

In the view of the extensive availability of the microbial pigments, their affinity towards different textiles, cost

effectiveness, and nontoxic nature, microbial pigments may increase their market appeal and could replace such synthetic colors which are toxic to mankind and nature. The *Thermomyces* and *Penicillium* pigment extract has the proton-donating ability and could serve as free radical inhibitors or scavengers, acting possibly as primary antioxidant. This promise has led to an explosion in nutrient containing products which are marketed for eco friendly dyeing for fabrics. The, *Thermomyces* and *Penicillium* pigment extract which is nontoxic, both cosmetic and dyeing, can be considered as antioxidant and antimicrobial agents for textile dyeing.

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