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The proton release and degree of Mo^{6+} reduction to Mo^{4+} as effected by the increase of concentration of formaldehyde in the PEM of 1.5 31211 SMJ8 during the exposure to sunlight

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Abstract
1.531211SMJ8 Jeewanu, the autopoetic eukaryote, was prepared under oxygenic conditions and the effect of addition of different concentrations of formaldehyde in the PEM on the degree of Mo $^{6+}$ reduction to $Mo^{4+}$and the proton release during exposure to sunlight was investigated. It was observed that on exposure to sunlight, the colourless form Mo^{6+} is changed to blue coloured Mo^{4+} in the PEM. The blue colour appeared after 10-15 minutes of exposure. The intensity of the blue colour was measured as absorbance with the help of a double cell photoelectric colorimeter. The pH of the five PEM solutions having different concentrations of formaldehyde was measured with the pH meter at different exposure period. The optimum formation and growth of the Jeewanu took place only up to 5.68% formaldehyde concentration in the PEM. Further increase in the concentration of formaldehyde in the PEM hinders the Jeewanu formation. The increase in the photochemical release of protons with increasing period of exposure was sharper in lower concentrations of formaldehyde in the PEM.

Keywords: SMJ8, Jeewanu, PEM, autopoetic, eukaryote, pH, formaldehyde, colour intensity

1. Introduction

The presence of formaldehyde in the prebiological era was possible because it can be formed in the aqueous solution of CO_2 on irradiation with ultraviolet light. [9, 19, 11]. Formaldehyde is used as a source of organic carbon in many abiogenic experiments for synthesis of amino acids. It also plays an important role in the study of life synthesis. [2, 3, 1]. Many scientists believe that formaldehyde might have played an important role in the formation of organic compounds in the primitive earth [15]. According to Synder [18], a large amount of formaldehyde has been found in the interstellar space and has been detected in a number of galactic and extragalactic sources [16]. Butlerov [8] reported that dilute aqueous alkali solution causes condensation of formaldehyde producing complex mixtures of sugars. The synthesis of sugars and formaldehyde by passing electric discharge in a mixture of methane, ammonia, water and hydrogen was done by Miller and Urey [13]. Briggs, M.H. [7] synthesized glucose and fructose on irradiation of sterilized aqueous mixtures of paraformaldehyde, biological minerals and ammonium phosphate with artificial light.

Beck [5] reported that a mixture of formaldehyde and potassium cyanide in solution produced peptone like substances with properties of simplest proteins. Bahadur, Ranganayaki and Santamaria [1] have demonstrated the formation of amino acids in sterilized aqueous solution of formaldehyde containing different inorganic catalysts by exposure to artificial light. When a solution of CO_2 is exposed to ultraviolet light in quartz vessel formaldehyde is formed. [4, 14, 10]. After a certain period, the formation of formaldehyde might have stopped due to the formation of ozone layer cutting off short UV and this formaldehyde might have been replaced by other organic substances for the synthesis of biologically important compounds.

The study reveals that the life synthesis using formaldehyde as a source of organic carbon has produced microstructures which have many of the biochemicals of the present day cell. One such microstructure was prepared photochemical by Bahadur and Ranganayaki [3], which was named Jeewanu, from an aqueous mixture of ammonium molybdate, diammonium hydrogen phosphate, biological minerals and formaldehyde. However, formaldehyde is a poison to the present form of life and if more than 2% of formaldehyde is present in a medium, no biological cell can survive in it. Hence, even if formaldehyde helped in the process of life synthesis as an initial source of organic carbon, it would have gradually been replaced by other less toxic organic substances and the initial Jeewanu would have adapted to these new sources of organic material. Many attempts were made to replace formaldehyde with other organic substances in the parental environmental medium of Jeewanu. It was found that 40% of the total need of formaldehyde was essential for the formation of Jeewanu in the PEM of molybdenum Jeewanu. Further decrease in the concentration of formaldehyde inhibits Jeewanu formation. Thus only 60% of the formaldehyde can be substituted by other organic carbon sources, such as acetic acid, methanol, ethanol and glucose. [12, 21, 17, 6, 20].

2. Experimental

The following solutions were prepared:

- 4% (w/v) ammonium molybdate
- 3 % (w/v) diammonium hydrogen phosphate
- Mineral solution: It was by mixing different mineral solutions in definite proportions.
- 36% formaldehyde was used in this experiment
- 3% (w/v) sodium chloride
- 5% (w/v) water soluble sodium silicate

Five clean, dry and sterilized corning conical flasks of 250cc capacity were taken and labeled 1 to 5. In each flask 15 ml ammonium molybdate and 30 ml di ammonium hydrogen phosphate was added. Then 10 ml of mineral solution was added to each flask. In flask 1 to 5, 5 ml, 10 ml, 15ml, 20 ml and 30 ml formaldehyde was added respectively and 15 ml, 10 ml, 5 ml, 0 ml and 0 ml of double distilled water was added to flask 1 to 5 respectively to make the total volume of each mixture equal except in mixture number 5, where the total volume was 85 ml. then 10 ml of sodium chloride and 10 ml of sodium silicate were added to each flask. Thus the total volume of flask 1 to 4 was 95 ml each and flask 5 has a total volume of 105 ml. the percentage by volume of formaldehyde was 1.9%, 3.8%, 5.7%, 7.6% and 11.4% respectively in flask 1 to 5 respectively.

Each flask was shaken well after adding each constituent, cotton plugged and exposed to sunlight for total 8 hours giving 2 hours exposure daily. The colorimetric reading and the pH readings were recorded after 10, 20, 30, 40, 50, 60, 70, 80, 90,100,110, 120, 240, 360 and 480 minutes respectively.

3. Observations

Colorimetric readings indicating the intensity of blue colour formed in the exposure mixture, caused by the reduction of Mo^{6+} to Mo^{4+} is shown in Table 1

Table 1: colorimetric readings indicating the intensity of blue colour formed in the exposure mixture, caused by the reduction of mo^{6+} to $mo^{4+.}$

Exposure time in minutes	Colorimetric readings				
	Percentage of formaldehyde in the PEM				
	1.9	3.8	5.7	7.6	11.4
10	26	30	3	47	108
20	34	57	127	153	234
30	56	60	144	147	208
40	51	118	195	196	240
50	30	131	228	220	248
60	32	125	210	226	238
70	43	145	214	200	242
80	52	156	218	202	192
90	70	140	179	140	160
100	90	160	198	154	195
110	100	178	210	162	212
120	104	189	234	174	238
240	140	212	248	182	264
360	188	262	264	185	284
480	125	238	238	127	228

pH of the five mixtures with increasing period of exposure is shown in Table 2

Table 2: pH of the five mixtures with increasing period of exposure.

Exposure time in minutes	pH of the PEM				
	Percentage of formaldehyde in the PEM				
	1.9	3.8	5.7	7.6	11.4
10	4.52	3.67	3.15	2.88	2.72
20	4.31	3.51	3.02	2.81	2.66
30	4.24	3.48	2.98	2.81	2.66
40	4.17	3.44	2.96	2.78	2.66
50	4.14	3.44	2.96	2.78	2.66
60	4.14	3.44	2.96	2.78	2.66
70	4.10	3.44	2.96	2.78	2.66
80	4.10	3.44	2.99	2.81	2.69
90	4.01	3.42	2.98	2.82	2.69
100	4.00	3.42	2.96	2.80	2.67
110	4.00	3.41	2.95	2.79	2.67
120	3.99	3.40	2.95	2.78	2.65
240	3. 99	3.40	2.93	2.75	2.62
360	3.98	3.38	2.92	2.75	2.61
480	3.9999	3.25	2.80	2.63	2.61

4. Discussion

The graph between colorimetric reading and exposure time reveals that with increase in the formaldehyde concentration in the PEM, the colorimetric reading increases rapidly up to 5.7 % formaldehyde addition. The initial reading also increases with increase in the formaldehyde concentration. However, when the concentration of formaldehyde in the mixture is up to 7.6% in the PEM, the reduction of Mo^{6+} to Mo^{4+} increases gradually. Further increase in the concentration of the formaldehyde does not affect the increase significantly. When the concentration of formaldehyde is 5.7% or more in the PEM, there is a steady increase in the intensity of blue colour of the mixture for the first 50 minutes, then there is decrease in the intensity of the blue colour between 50 and 90 minutes and then it increases again. After 360 minutes of exposure, the intensity of blue colour decreases at all the concentrations of formaldehyde investigated.

This indicated that only up to 5.7% concentration of formaldehyde in the PEM, optimum formation of Jeewanu and their growth is recorded. (Geeta Kesarwani, 1986). Further increase in concentration of formaldehyde in the PEM hinders the formation of the Jeewanu.

The investigation of pH of the exposed mixture with exposure period indicates that the initial pH of the PEM decreases with increasing concentration of formaldehyde in the PEM. It is also observed that the pH decrease is sharper when the concentration of formaldehyde is less. Thus the total decrease in the pH f the PEM during 480 minutes of exposure to sunlight at different concentrations of formaldehyde is as follows:

Table 3

S. No.	Percentage of formaldehyde in the PEM	Decrease in the pH
1	1.9	0.250
2	3.8	0.215
3	5.7	0.165
4	7.6	0.115
5	11.4	0.051

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