



Cassava Starch as A Partial Substitute to Agar - Agar in Microbiological Media

Siddhi Shinde and S.S. Kanase

Department of Microbiology, Yashwantrao Chavan Institute of Science, Satara, Maharashtra, India, 4150 001

Corresponding author: Dr. Mrs. S.S. Kanase (Email ID: shivangikanase7@gmail.com)

ABSTRACT

Cassava starch powder act's as a solidifying agent. It is also known as tapioca powder and sago powder. It is available in the form of cassava pearls in the local market. Cassava (manihot esculenta) was assessed as an alternative starch source. It is not only used for isolating fungal species but also stimulates the growth of organisms and plants. Agar is one of the expensive ingredients. To avoid such expenses, we replaced the agar composition with cassava powder (a low-cost ingredient), and we have observed well-isolated colonies on the agar plate using different microorganisms. This research probes the probability of cassava starch as a thickening agent and partial substitute for agar-agar in microbiological solid media.

KEYWORDS: Cassava, Nutrient agar, Agar-agar, Powder, Tapioca.

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INTRODUCTION

Agar-Agar powder is used as a solidifying agent for the cultivation of microorganisms [1] However, the price of high media agar-agar powder for 500g in India ranges from 4500 to 5000. This makes it very expensive for educational institutes and industries too. For 500 milligrams, the cost of starch powder is Rs. 25. This makes it a significantly less expensive alternative to agar-agar powder. Agar manufacturing challenges include the extremely challenging growth of the red seaweed and geranium utilised in the process[11], The largest agar producer in the world is Japan[11]. which has 2/3rd of the agar market, relies on natural winter weather for agar production Inconsistencies due to seasonal changes and subsequent availability of agar are observed in various laboratories throughout the world. This fact demands a search for a more readily available substitute for agar. The aim of the study was to find a cheaper local gelling agent which would have the capacity to substitute agar for solid culture media preparation. A solidifying agent used in culture media should be transparent and the medium should be stable enough to carry out various techniques used for isolation and cultivation of organisms. The gelling agent should be easily available and relatively inexpensive [8][10]. Cassava starch can be used as a solidifying agent alternative to agar in emergent nations[12][6]. The gelling ability of cassava starch is well known. Many scientific researchers, including Gerbre and Santhya Narayana in 2001 and Kasanadze in 2000, have confirmed it[9]. The objective of the study was to evaluate the gelling ability of cassava starch with varying percentages of agar-agar powder. The effect of cultivating ability and cultural morphological characteristics of the varying percentages of agar and cassava was studied.

MATERIAL AND METHODS

Tapioca pearls, or cassava pearls, were collected from the local market. Then dried it and ground the tapioca pearls with the help of a grinding mixer 2-3 times. After this, we got tapioca pearls in the form of powder. We sieved the powder due to which we obtained fine particles of powder For nutrient agar in 250 ml conical flasks, 100 ml of distilled water is added. with a different composition of tapioca powder for 100 ml of nutrient agar. A medium containing different concentrations of agar-agar powder and cassava starch powder was prepared as given in the table.

Table 1:- Variation in concentration of Agar-agar and Cassava powder

Sr.No	100 ml Nutrient agar	Agar concentration	Cassava powder concentration
1	100%	3 gm	0 gm
2	75%	2.25 gm	0.75 gm
3	50%	1.5 gm	1.5 gm
4	25%	0.75 gm	2.25 gm

The PH of the agar and tapioca powder was adjusted to 7 and autoclaved at 121 °C for 15 minutes. After autoclaving, pour Nutrient Agar medium into sterile petriplates in aseptic condition. Allow 10 minutes for the media to solidify. Later, streak plates using the four-quadrant streaking method. Various microorganisms, such as *Bacillus subtilis* and *Shigella* spp., were used and incubated for 24 hours at 37°C.

Note—100 ml of medium containing 3% agar powder was considered a control, having 100% agar concentration.

RESULT

Colonies on plates containing agar concentration replaced by cassava powder concentration as shown in the table were observed. morphological and cultural characteristics, further confirmed by staining. 100% Nutrient agar showed normal morphological and cultural characteristics as well as staining of the organism similar observation was noted. up to 50% Agar and 50% Cassava powder were similar to that of 100% agar-agar. In control control plate which contain normal percent of agar powder that is 3% agar powder. Further increase in concentration of cassava powder and decrease in concentration of agar-agar powder in the medium resulted in semi-solid medium which did not support streaking, In This it is observed that medium contain 50% agar and 50% cassava powder can be used for practical purposes.

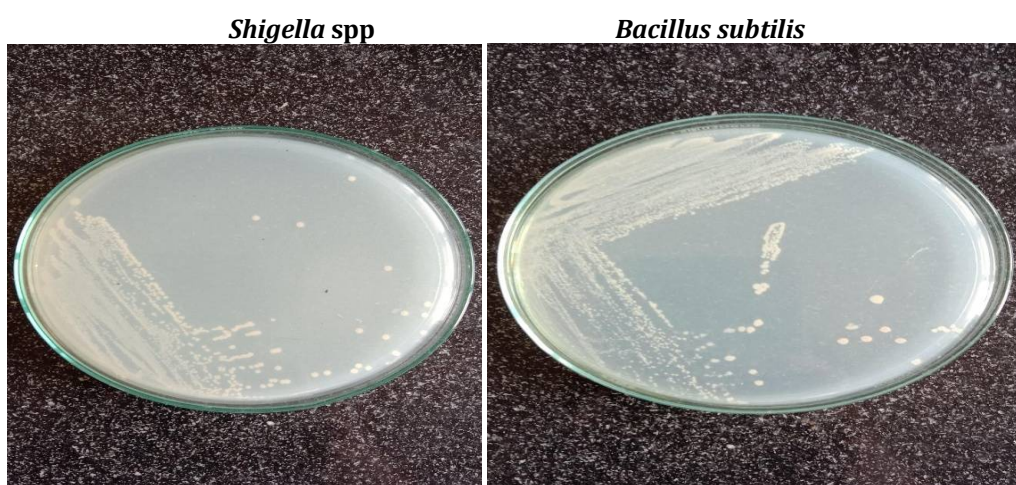


Figure 1:- 100% Nutrient Agar

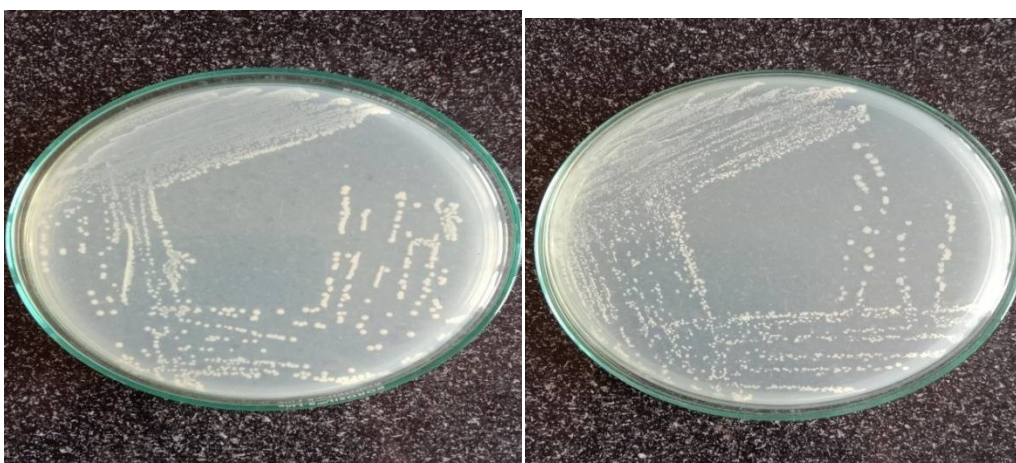


Figure 2:- 75% Agar powder + 25% Cassava powder

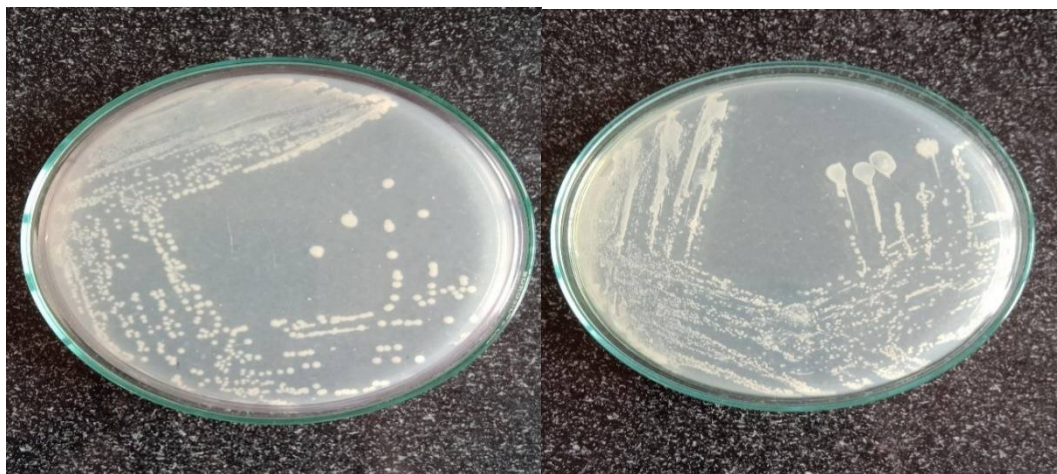
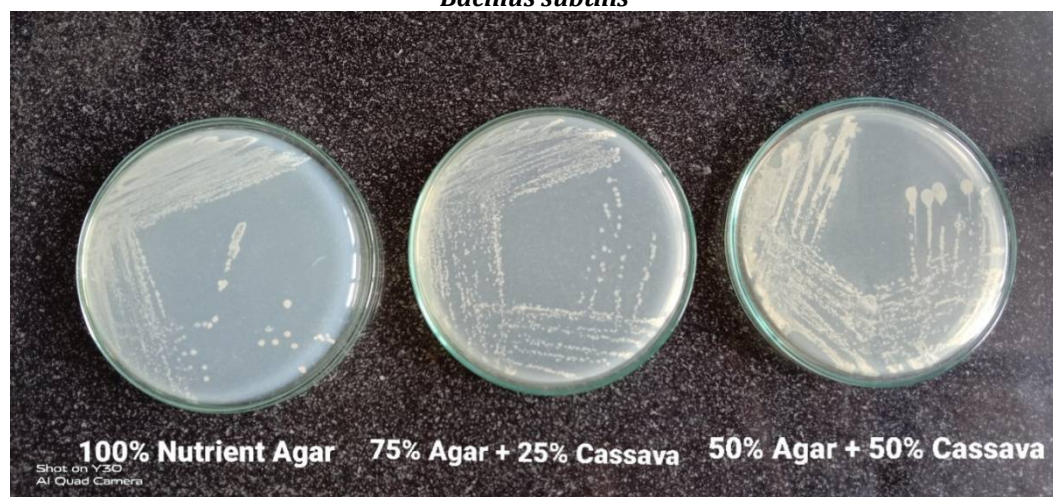


Figure 3:- 50% Agar powder + 50 % Cassava powder

**Fig 4: Comparative Analysis of Isolated colonies on different agar composition
*Shigella Spp***



Bacillus subtilis



DISCUSSION

Cassava flour has solidifying attributes which are used for plant tissue culture media [3][5]. Starch and plant gum are used as inexpensive sources for fungal growth. In this study, PDA (potato dextrose agar) was used, but cassava was used as an alternative to the starch media source in which it plays an important role for isolating fungal species[6]. It acts not only as an alternative to agar but is also used for isolating endophytic fungi. Using cassava instead of potato increased the isolation of some fungal spp on MDA (manihot esculenta agar) compared to PDA [2]. pH can affect the stability of cassava flour. According to Umeh, B.U. and Uguru, M.I.'s experiment, cassava has a higher average number of pods per plant than agar. It not only stimulates the growth of organisms but also of plants. Cassava starch is 50 times less

expensive than agar [4]. However, by reducing the need to import agar, cassava will gain more acceptance as a cheaper alternative in Nigeria [4].

CONCLUSION

Taking into consideration the high price of agar-agar powder, which becomes a burden to the economic status of educational and research institutes In developing countries, the experimental work performed suggests that cassava powder can be used as a 50% replacement for agar-agar powder as a solidifying agent, conserving the morphological and cultural characteristics of organisms. Thus, the expense of agar-agar powder can be reduced.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

REFERENCE

1. Dabai, Y. U., & Muhammad, S. (2005). Comparative study on agar and cassava gelled media in vitro propagation of ginger. *African Journal of Biotechnology*, 4, 15-25
2. Sia, E.d.F., Marcon, J., Luvizotto, D.M. et al. (2013). Endophytic fungi from the Amazonian plant *Paullinia cupana* and from *Olea europaea* isolated using cassava as an alternative starch media source. *Springer Plus* 2, 579. <https://doi.org/10.1186/2193-1801-2-579>
3. Santana, M. A., Romy, G., Matehus, J., Villardon, J. L., & Demey, J. R. (2009). simple and low-cost strategy for micropropagation of cassava (*Manihot esculenta* Crantz). *African Journal of Biotechnology*, 8. Retrieved from <http://www.academicjournals.org/ajb/>
4. Umeh, B. U., & Uguru, M. I. (2013). Comparative study on agar and cassava gelled media in vitro propagation of ginger. *African Journal of Agricultural Research*, 8. <https://doi.org/10.5897/AJAR12.1831>
5. Kuria, P., Demo, P., Nyende, A., & Kahangi, E. (2008). Cassava starch as an alternative cheap gelling agent for the in vitro micro-propagation of potato (*Solanum tuberosum* L.). *African Journal of Biotechnology*, 7.
6. Kwoseh, C., Asomani-Darko, M., & Adubofour, K. (2012). Cassava starch-agar blend as alternative gelling agent for mycological culture media. *African Journal of Biotechnology* Vol. 7 (3), pp. 301-307.
7. Apiron, D. and Watson, N. (1976). Substitute for Agar in solid Media for Common usage in microbiology. *Applied and environmental microbiology*, American society for microbiology 31:509-513
8. Gerbre, E. and Sathyanarayana, B. N. (2001). Tapioca A new and cheaper alternative to agar for direct in vitro regeneration and microtuber production from nodal cultures of potato. *Africa Crop Science Journal* 9: 1- 8
9. Ssamula, A., & Mukasa, S. B. (2015). Use of cassava starch as gelling agent during in vitro micropropagation of banana. *Journal of Experimental Biology and Agricultural Sciences*, 3(2320-8694). <https://doi.org/10.18006/2015>.
10. UNDP/FAO Fisheries manual (1990). Training manual on Gracilaria culture and seaweed processing in China. FAO cooperate document repository, Fisheries Department. pp104
11. Mbanaso ENA, Crouch J, Onofeghara FA, Pillay M (2001). Cassava Starch as Alternative to Agar for Gelling Tissue Culture Media. A paper presented at a conference on Cassava, an ancient crop for modern times held at Donald Danforth Plant Science Center, St. Louis, Missouri, Nov. 4-9, 2001.

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