ECP 2024 Conference

The 3rd International Electronic Conference on Processes

29–31 May 2024 | Online

Application of of thiolated silica nanoparticles in food industries

Shakeel Ahmed Ansari[1], Rukhsana Satar[2]

Department of Biochemistry, Medicine Program, [1]Batterjee Medical College, Jeddah, Saudi Arabia

[2]Ibn Sina National Medical College, Jeddah, Saudi Arabia

INTRODUCTION & AIM

- Lactose intolerance is an inability to completely digest lactose present in dairy items Hence, such discomfort level leads to diarrhea, nausea, vomiting, gas and bloating.
- Over the counter tablets or drops containing the lactase (β galactosidase), help in digesting such dairy products.
- In another approach, immobilized biocatalysts are utilized for obtaining lactose free dairy products due to their greater stability and reusability Such immobilized preparations also retained higher enzyme activity in extreme conditions.

METHOD

- Thiol functionalized silica nanoparticles were prepared via sol gel process Fifty ml NaOH 14 mM) was heated by vigorous stirring at 7070°C followed by the addition of tetraethyl orthosilicate 50 µl) and mercaptopropyl trimethoxysilane 100 µl) after 5 minutes β galactosidase was immobilized on thiolated Si NPs. The reaction was allowed to continue for 3 hours.
- Stability of soluble and immobilized β galactosidase was analyzed at various pH and temperature ranges.
- Batch conversion of lactose:
  Lactose solution was stirred continuously with soluble and immobilized enzyme independently at
  50 °C and 60 °C in water bath for 10 h The aliquots were drawn after every hour and assayed for glucose estimation by glucose oxidase peroxidase assay kit.

RESULTS & DISCUSSION

- Cloudy nanoparticle suspension were collected by centrifugation.
- Immobilized enzyme exhibited remarkable stability at varying pH [Fig 1 and temperature ranges [Fig 2 as compared to the native enzyme.
- Improved conversion of lactose was monitored by β galactosidase conjugated to modified SiNPs at higher temperature ranges [Table 1].

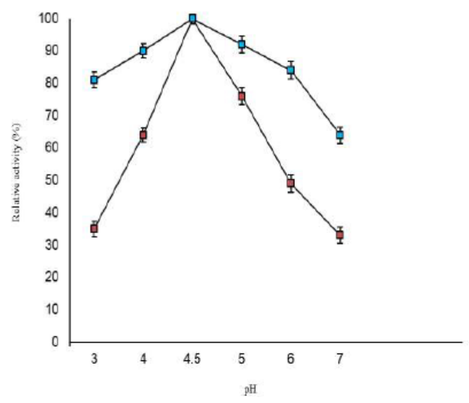

Figure 1. pH-activity profile

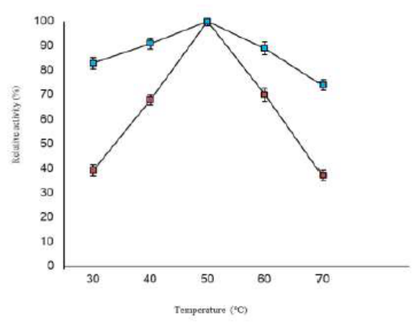

Figure 2. Temperature-activity profile

Table 1. Lactose hydrolysis

Time (h)	Lactose hydrolysis (%)			
	60 °C		50 °C	
	Soluble enzyme	Immobilized enzyme	Soluble enzyme	Immobilized enzyme
Control	0	0	0	0
1	11±2.3	8±2.6	16±4.3	12±2.6
2	18±3.1	17±2.4	25±2.4	32±4.6
3	23±4.6	33±3.1	33±3.4	44±2.8
4	39±1.9	48±4.1	42±3.7	57±2.6
5	44±2.1	51±3.3	49±2.9	65±1.6
6	51±2.3	62±1.2	57±1.3	70±2.6
7	54±3.2	66±2.8	63±1.5	74±4.4
8	58±1.7	70±1.4	66±1.9	74±2.8
9	58±3.5	70±3.7	70±4.3	81±1.6
10	58±2.8	70±2.8	70±3.0	81±3.5

CONCLUSION

Greater conversion of lactose was obtained by β galactosidase conjugated to thiolated SiNPs at high temperature Hence, it could prove useful in suggested biotechnological application.

FUTURE WORK / REFERENCES

1. Ansari SA, Damanhory AA. *Heliyon* 2023,9, e13089
2. Alzahrani F, Akanbi TO, Scarlett CJ, Aryee ANA. *Processes* 2024, 12, 634
3. de Freitas LA, de Sousa M, Ribeiro LB, de Franca IWL, Goncalves LRB. *Catalysts* 2023,13, 306

Email: shakeel.ansari@bmc.edu.sa