A Feasibility Study of Novel Granular Activated Carbon for Monosodium Glutamate on Decolorization process

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Abstract

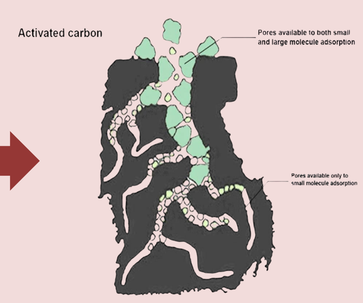
This study aimed to evaluate the decolorization efficiency of granular activated carbon (GAC) used in the monosodium glutamate (MSG) production process. The CL-K type GAC was used as a reference and compared with two alternative GAC types, namely BM and Jacobi. The performance evaluation was based on decolorization efficiency, regeneration efficiency, color return speed, and impurity characteristics. The results demonstrated that CL-K type GAC exhibited the highest performance, with an average decolorization efficiency of 40%, a high iodine value, and stable regeneration efficiency of 100%. The BM type GAC showed slightly lower decolorization efficiency; however, after optimizing the regeneration conditions by increasing hot water volume or elevating the regeneration temperature to 70–80 °C, its regeneration efficiency could be restored to 100%, indicating its potential as an alternative GAC. In contrast, The Jacobi type GAC showed the lowest decolorization efficiency and iodine value, failing to meet the minimum performance requirement even after regeneration optimization. No significant differences were observed in color return speed and impurity levels among the three GAC types. Therefore, the CL-K type GAC remains the most suitable material for industrial application, while BM type GAC may serve as a potential alternative under optimized regeneration conditions. The Jacobi type GAC is not recommended for practical use.

Introduction

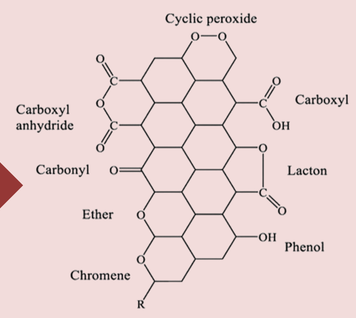
Granular Activated Carbon



Granular activated carbon (GAC)



Porous structure for adsorption



Functional groups
[-OH, -COOH, C=O]

GAC function : Adsorption impurity
[Organic compound, Colors, Smell]

Research Objectives

- To compare the newly developed granular activated carbons (BM and Jacobi) with the existing CL-K type and evaluate their potential as alternatives for MSG decolorization.

Research Methodology

Activation	Decolorization	Regeneration
Activated carbon activation process before decolorization	Decolorization process using activated carbon	Activated carbon regeneration process after decolorization

Aspects	Details
Evaluation Point • **%**Decolorization ability	To assess GAC effectiveness in color removal for MSG production.
Monitoring Point • Color return speed • %Regeneration efficiency • Impurity	To compare color return rate, regeneration efficiency, and impurity impact with the current GAC.

Results and Discussion

Decolorization ability

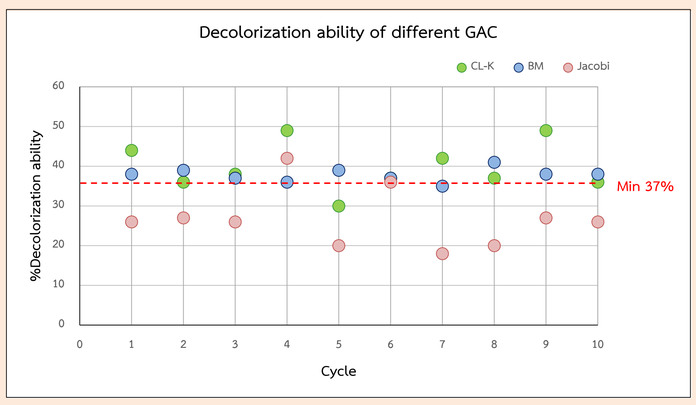


Fig 1. Decolorization ability of different Granular activated carbon

The BM-type GAC exhibited stable decolorization (~38%), which is close to that of the existing type (~40%), but slightly lower due to its lower iodine value.

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Results and Discussion

Color return speed

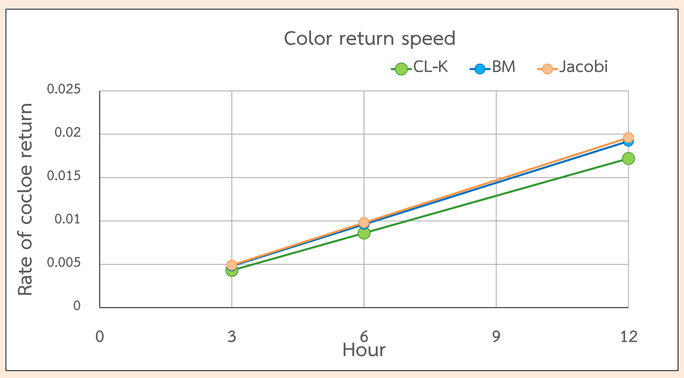


Fig 2. Color return of different Granular activated carbon

The results indicate that CL-K, BM, and Jacobi GAC types exhibit similar color return speeds, with no significant differences.

Impurity analysis

Impurity	Impurity values (ppm)					
	existing 1RV	A 1RV	B 1RV	existing 60RV	A 60RV	B 60RV
X1	31	31	33	71	70	75
X2	37	35	39	272	278	276
X3	301	308	334	276	278	306
X4	1458	1426	1428	5265	5279	5320
X5	7	10	9	19	22	23
X6	20	21	22	41	44	42
X7	8	7	10	30	30	32
X8	25	29	24	22	23	24
X9	14	17	12	35	33	36

Fig 3. Impurity analysis of different Granular activated carbon

Impurity levels of CL-K, BM, and Jacobi are comparable, with no significant differences, and have no impact on product quality.

Regeneration

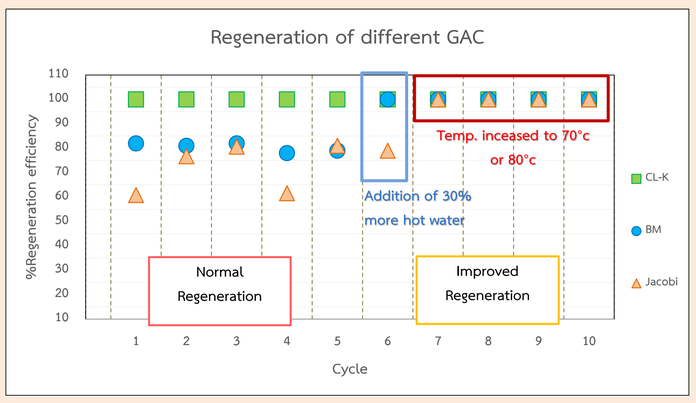


Fig 4. Regeneration of different Granular activated carbon

All three GAC types (CL-K, BM, and Jacobi) achieved 100% regeneration efficiency, which is required to maintain stable decolorization in subsequent cycles.

BM-type GAC can achieve 100% regeneration, comparable to CL-K, when the regeneration process is improved by:
1. adding 30% more hot water
2. increasing the temperature

Conclusion

The existing GAC showed the highest performance with 40% decolorization and an iodine value of 1680 mg/g, maintaining 100% regeneration efficiency. BM-type GAC demonstrated slightly lower performance but achieved full regeneration after process optimization, indicating its potential as an alternative. Jacobi GAC showed the lowest performance and did not meet the required standard even after improvement. No significant differences were observed in color return speed and impurity levels. Thus, the existing GAC remains the primary standard, while BM-type GAC may serve as a backup option.

References

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