AIR POLLUTION CONTROL OF FISH MEAL & OIL INDUSTRY USING BIO-FILTERS

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Keywords

Fish Meal & Oil Industry, Methyl Amine, Reduction Noxious Odours, Bio-Filters, Adsorption.

Introduction

Fish tissues are rendered in order to extract the precious oil, which is high in omega-3 fatty acids and other beneficial substances. This technique can be problematic for the workers as well as the neighbouring community because it frequently generates offensive and sometimes dangerous aromas into the surrounding area. These smells are strong and poisonous, which can make it difficult to comply with environmental regulations and lower the general standard of living in the neighbourhoods that surround fish processing plants. Our project's reaction to this problem canters on putting in place a complex plan to lessen the harmful aromas that fish oil extraction tanks emit. The main goal is to provide an efficient and practical approach that can be easily incorporated into current processing facilities without sacrificing quality.

Objectives

- To evaluate the effectiveness of activated charcoal and citric acid in reducing noxious odors during fish meal & oil extraction as a bio-filters.
- To determine the practical applicability of these odor-reducing agents within the fish processing industry.
- To improve the working environment for overall quality of life in the areas surrounding of the fish processing facilities and pose environmental compliance challenges.
- To enhance the quality of life for communities located near fish processing facilities by minimizing the impact of noxious odors.

Methodology

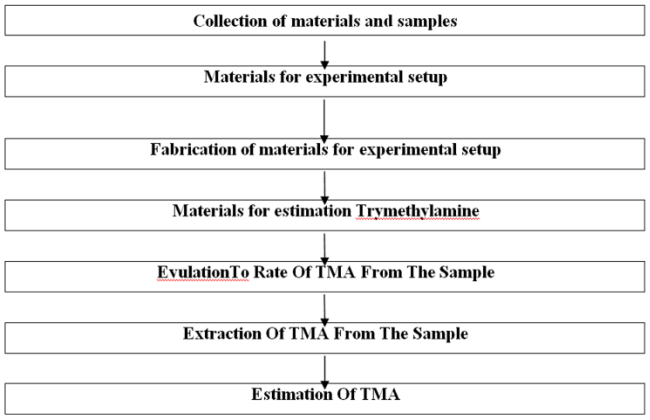
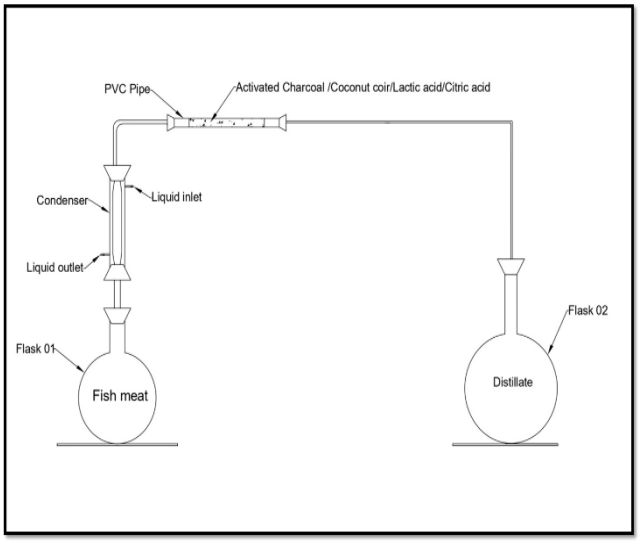


Fig. 1: Raw material – Fish

Fig. 2: Extracted Sample From The Steam Without Filter Media

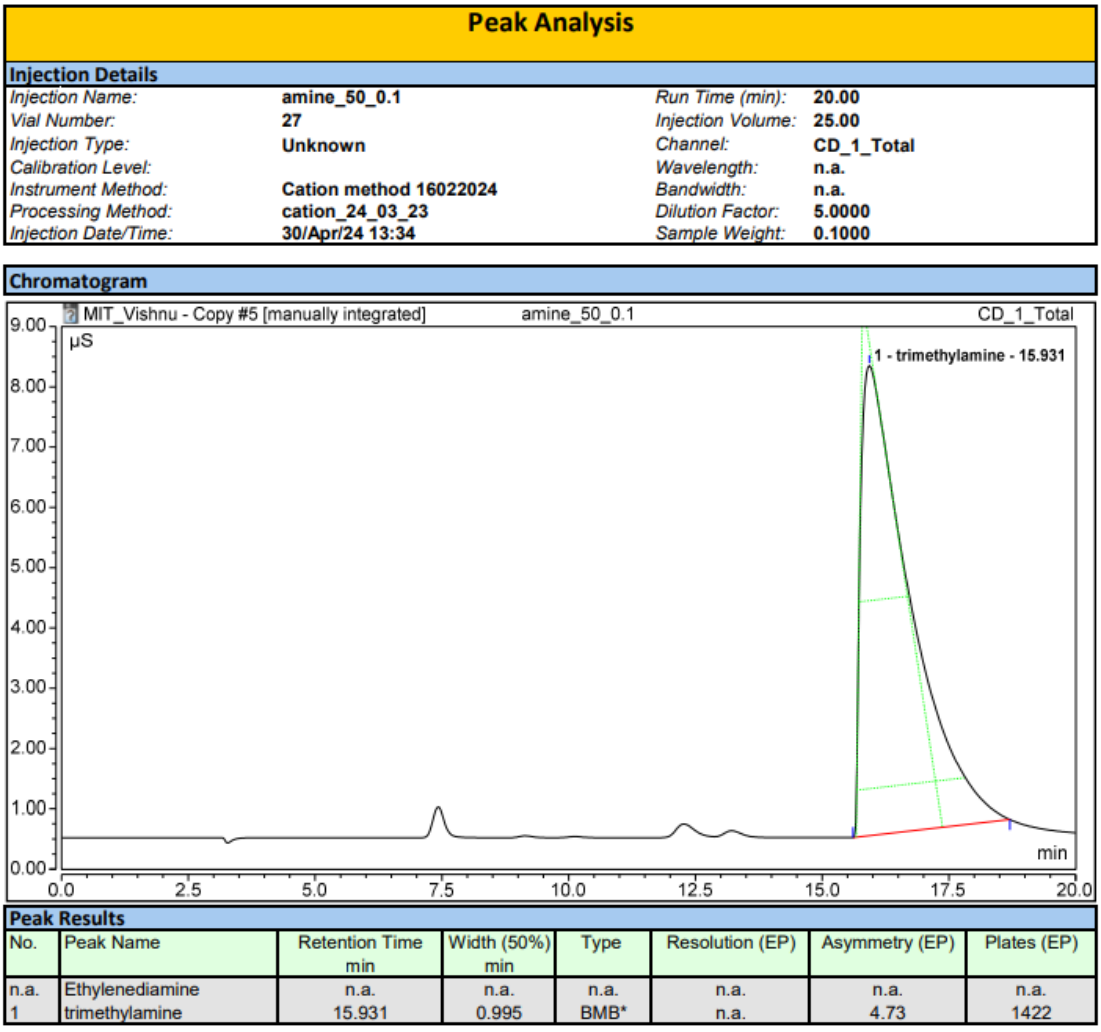
Fig. 3: Extracted Sample From The Steam Using Coconut Charcoal As A Filter Media



Results

Retention time, peak shape, peak height, and area under the curve are typical features of the trimethylamine peak in the chromatograph.The amount of time it takes for trimethylamine to elute from the chromatographic column and arrive at the detector is known as the retention time. Information regarding the effectiveness of the chromatographic separation process can be obtained from peak shape and resolution

Extracted Sample from the steam using coconut charcoal as a filter media and testing the sample in ion chromatograph. Retention time, peak shape, peak height, and area under the curve are typical features of the amine peak in the chromatograph.



Peak Analysis

Injection Details

Injection Name:	**amine_50_0.1**	*Run Time (min):*	**20.00**
Vial Number:	**27**	*Injection Volume:*	**25.00**
Injection Type:	**Unknown**	*Channel:*	**CD_1_Total**
Calibration Level:		*Wavelength:*	**n.a.**
Instrument Method:	**Cation method 16022024**	*Bandwidth:*	**n.a.**
Processing Method:	**cation_24_03_23**	*Dilution Factor:*	**5.0000**
Injection Date/Time:	**30/Apr/24 13:34**	*Sample Weight:*	**0.1000**

Chromatogram

Peak Results

No.	Peak Name	Retention Time min	Width (50%) min	Type	Resolution (EP)	Asymmetry (EP)	Plates (EP)
n.a.	Ethylenediamine	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1	trimethylamine	15.931	0.995	BMB*	n.a.	4.73	1422

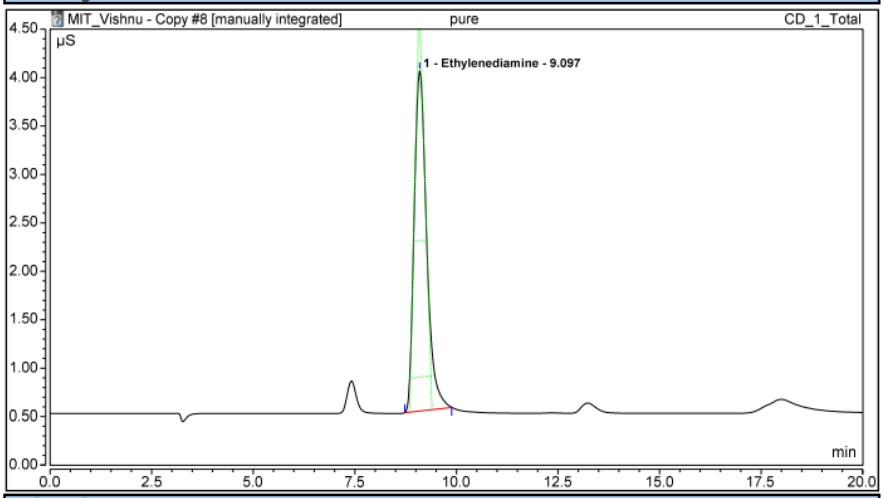
Fig. 4: Standard sample trimethylamine of peak graph

Peak Analysis

Injection Details

Injection Name:	**pure**	*Run Time (min):*	**20.00**
Vial Number:	**32**	*Injection Volume:*	**25.00**
Injection Type:	**Unknown**	*Channel:*	**CD_1_Total**
Calibration Level:		*Wavelength:*	**n.a.**
Instrument Method:	**Cation method 16022024**	*Bandwidth:*	**n.a.**
Processing Method:	**cation_24_03_23**	*Dilution Factor:*	**5.0000**
Injection Date/Time:	**30/Apr/24 15:26**	*Sample Weight:*	**0.1000**

Chromatogram



Peak Results

No.	Peak Name	Retention Time min	Width (50%) min	Type	Resolution (EP)	Asymmetry (EP)	Plates (EP)
1	Ethylenediamine	9.097	0.327	BMB*	n.a.	1.38	4276
n.a.	trimethylamine	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

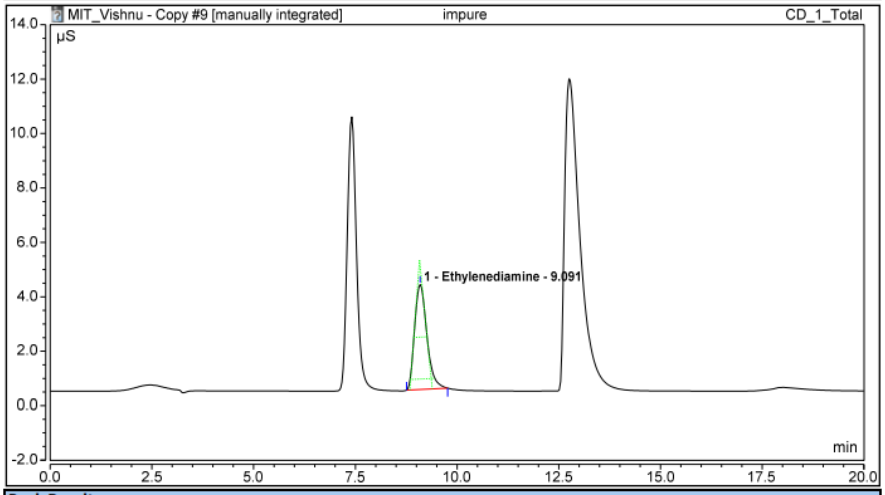
Fig. 5: Pure sample peak graph

Peak Analysis

Injection Details

Injection Name:	**impure**	*Run Time (min):*	**20.00**
Vial Number:	**34**	*Injection Volume:*	**25.00**
Injection Type:	**Unknown**	*Channel:*	**CD_1_Total**
Calibration Level:		*Wavelength:*	**n.a.**
Instrument Method:	**Cation method 16022024**	*Bandwidth:*	**n.a.**
Processing Method:	**cation_24_03_23**	*Dilution Factor:*	**5.0000**
Injection Date/Time:	**30/Apr/24 15:48**	*Sample Weight:*	**0.1000**

Chromatogram



Peak Results

No.	Peak Name	Retention Time min	Width (50%) min	Type	Resolution (EP)	Asymmetry (EP)	Plates (EP)
1	Ethylenediamine	9.091	0.328	BMB*	n.a.	1.34	4261
n.a.	trimethylamine	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Fig. 6: Impure sample peak graph

Summary			
Sequence Details			
Name:	**MIT_Vishnu - Copy**	*Created On:*	**01/Apr/24 14:36:56**
Directory:	**external**	*Created By:*	**NITK IC**
Data Vault:	**ChromeleonLocal**	*Updated On:*	**09/May/24 13:38:51**
No. of Injections:	**9**	*Updated By:*	**NITK IC**
By Component	**Ethylenediamine**		

No.	Injection Name	Ret.Time min CD_1_Total Ethylenediamine	Area µS*min CD_1_Total Ethylenediamine	Height µS CD_1_Total Ethylenediamine	Amount CD_1_Total Ethylenediamine	Rel.Area % CD_1_Total Ethylenediamine	Peak Type CD_1_Total Ethylenediamine
1	amine_1	9.067	0.189	0.542	10.034	100.00	BMB*
2	amine_2	8.797	0.368	1.115	19.932	100.00	BMB*
3	amine_3	8.451	0.551	1.620	30.034	100.00	BMB*
4	blank	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
5	amine_50_0.1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
6	amine_50_0.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
7	amine_50_1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
8	pure	9.097	1.253	3.513	3440.045	100.00	BMB*
9	impure	9.091	1.357	3.854	3727.744	100.00	BMB*

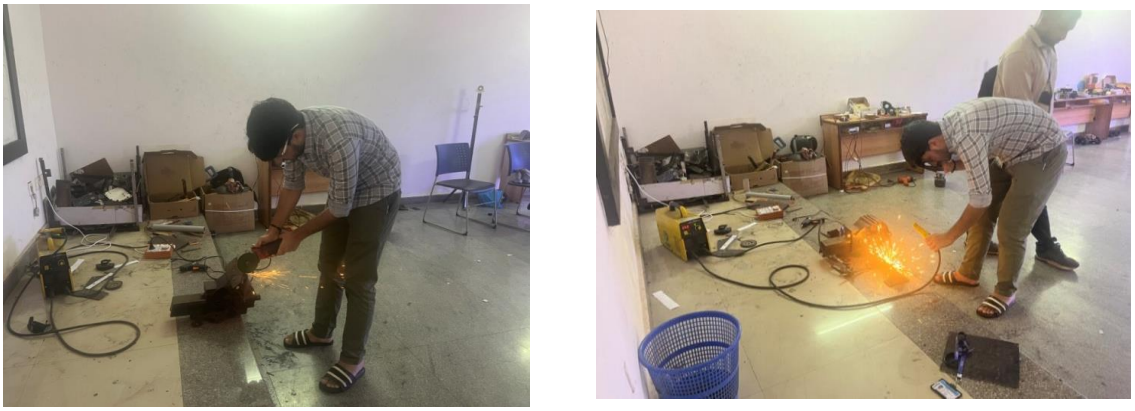


Fig. 7: Fabrication Work Conducted

Fig.8: Experimental Prototype Setup

Fig. 9: Ion Chromatograph Instrument at NITK

Conclusion

- Reduction of noxious odours during fish oil extraction/other industries, leading to a more pleasant and healthier life in the areas surrounding.
- Enhanced compliance with environmental regulations by minimizing odour emissions, reducing the risk of potential fines and legal issues.
- Improved quality of life for nearby communities through a reduction in foul odors from fish processing facilities/other industries.
- The potential for the fish processing industry/other industries to adopt innovative and sustainable practices in odor control.
- Contributing to a healthier and more environmentally responsible fish processing industry, benefiting both the workforce and local communities.

Future work scope

The fish oil extraction industry plays a critical role in providing essential omega-3 fatty acids and other valuable compounds to consumers worldwide. However, this process often generates toxic and noxious odors due to Methyle Amine, Dimethyleayne, Trimethylamine (TMA) gas etc., which pose serious ecological and socio-environmental problems and are considered strong environmental pollutants.

Future work is essential in this field to study encompasses evaluating the effectiveness of using other biological agents viz. acetic acid, lactic acid, and various biological adsorbents in reducing toxic odors from fish meal & oil extraction as well as other related like industries rubber/tannery/agriculture/Paper/pharmaceuticals processing industry, aiming to provide a comprehensive odor mitigation solution.