A Novel Prototype Photoreactor for the Removal of Emerging Contaminants from Industrial Sewage through Solar-Driven Photocatalysis

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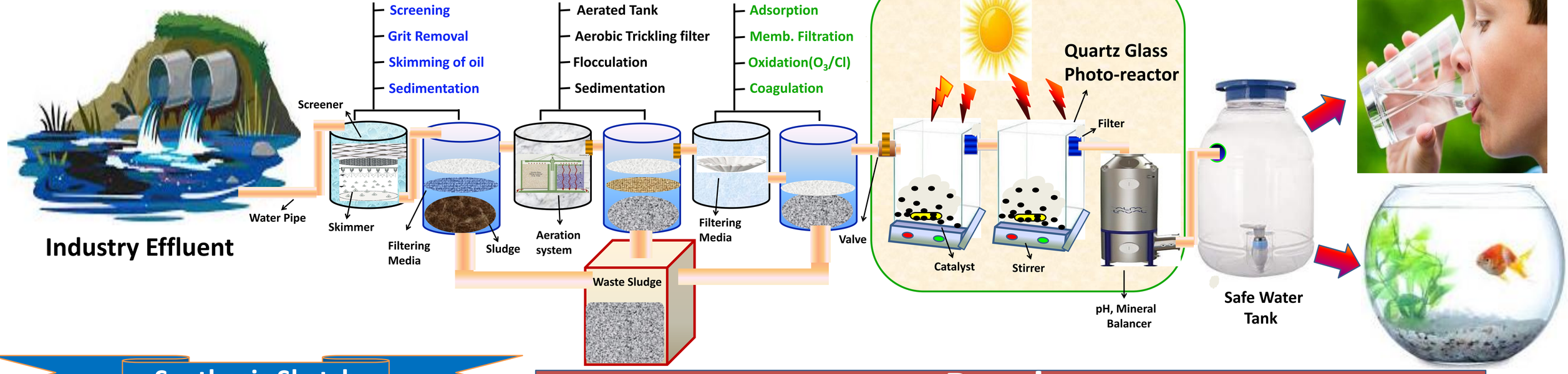
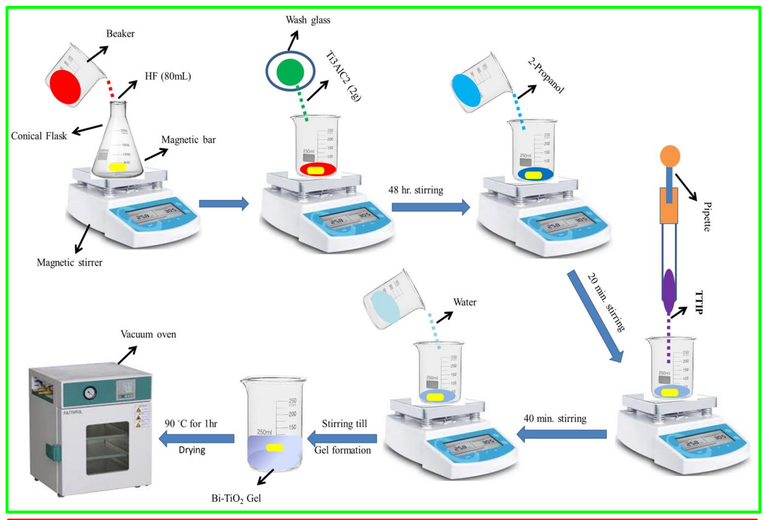
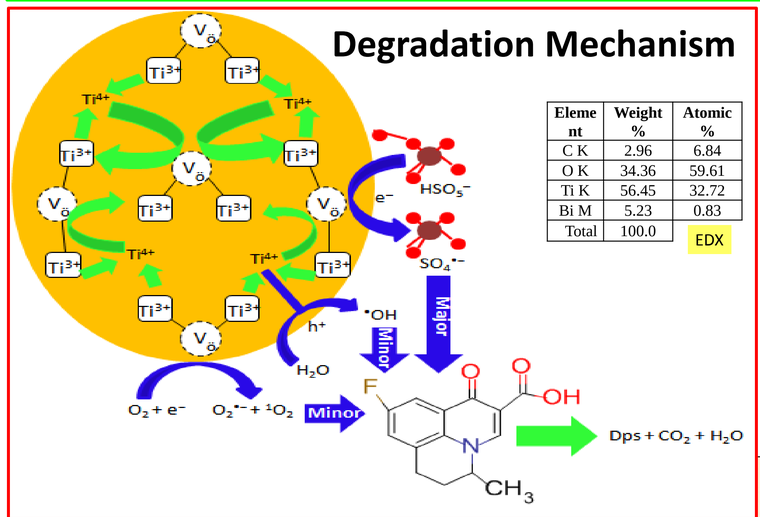
PROTOTYPE



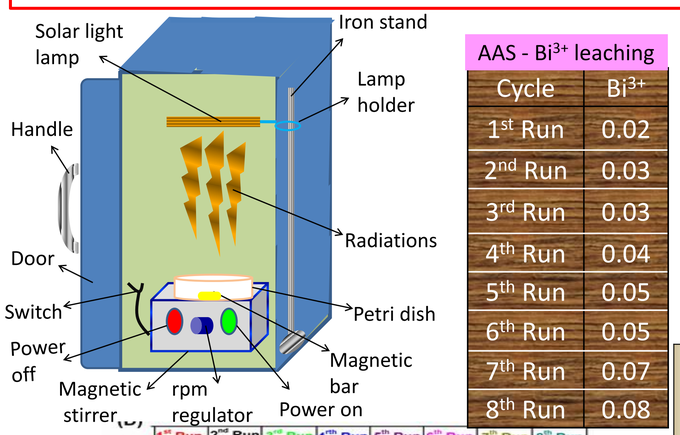
Synthesis Sketch





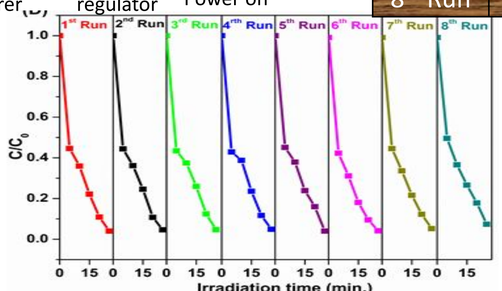
Element	Weight %	Atomic %
C K	2.96	6.84
O K	34.36	59.61
Ti K	56.45	32.72
Bi M	5.23	0.83
Total	100.0	

EDX

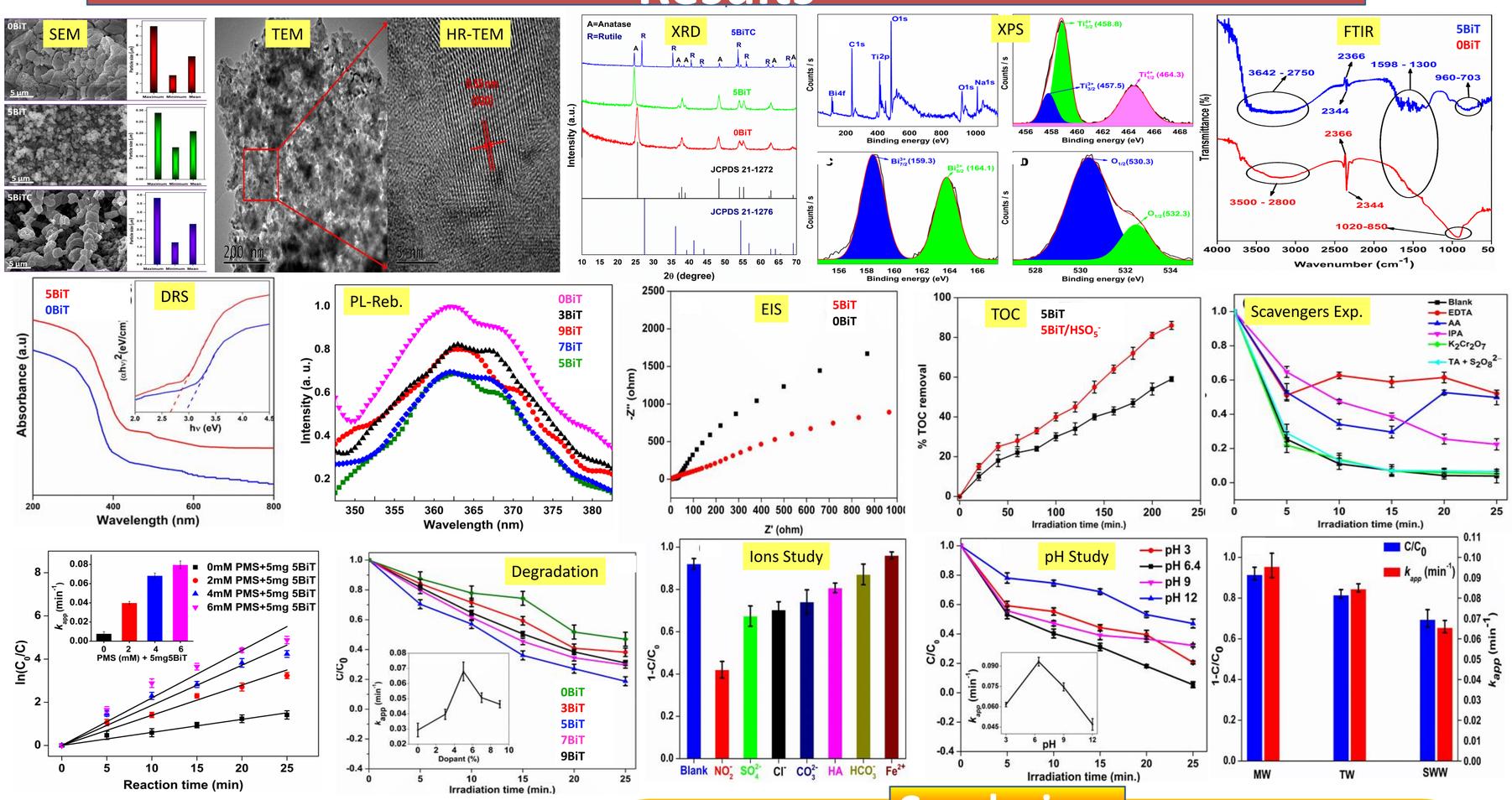


AAS - Bi^{3+} leaching

Cycle	Bi^{3+}
1st Run	0.02
2nd Run	0.03
3rd Run	0.03
4th Run	0.04
5th Run	0.05
6th Run	0.05
7th Run	0.07
8th Run	0.08



Results



S. No	Material	S_{BET} (m^2/g)	Pore volume (cm^3/g)	Specific Surface Area (10^4 m^2/g)	Pore size (nm)	Porosity (%)	Particle size (nm)	Crystal size (nm)
1	0BiT	21.1	0.01	38.72	3.3	4.5	72.5	3.8
2	3BiT	95.9	0.02	54.69	3.1	10.1	15.9	3.3
3	5BiT	216.8	0.07	78.94	3.0	29.8	7.0	2.1
4	5BiTC	177.6	0.05	63.53	2.9	20.3	8.6	2.5

Compound/ m/z	Acute toxicity			Chronic toxicity		
	Fish (LC_{50}) Duration 96 h	Daphnia (LC_{50}) Duration 48 h	Green Algae (EC_{50}) Duration 96 h	Fish (ChV)	Daphnia (ChV)	Green Algae (ChV)
FLU/262	784	420	284	174	74.4	123
DP1/235	86.2	91.9	45.1	27.5	0.755	13.7
DP2/219.2	193	125	75.1	55.8	19.5	25
DP3/219	15.6	6.48	5.16	2.45	1.37	3.15
DP4193	42.9	115	3.31	14.7	6.73	23.1

Conclusions

- The proposed novel technique is economical and efficient for photodegradation of FLU.
- The excellent performance of as-synthesized 5BiT material could be attributed to;
  1. defect sites, anatase and crystalline
  2. optimized band gap and formation of less toxic by-products
  3. less recombination rate of charge carriers/increased rate of charge transfer
  4. more hydroxyl radical generation and enhanced photocurrent response
  5. mesoporous nature (high porosity) and high surface area
  6. effectively doping of Bi^{3+} into TiO_2
  7. highly reusable, chemically and thermally stable
  8. active in visible and NIR region, clean and green technology
- All these phenomena could be observed from their respective characterization techniques.
- FUTURE PERSPECTIVE

  Photocatalytic H_2 production from water splitting , Approachable solution to increasing energy demands-green energy production.

References

1. **Ikhtiar Gul**, Murtaza Sayed, Noor S. Shah. Chemical Engineering Journal. 384, (2020), 123255.
2. **Ikhtiar Gul**, Murtaza Sayed, Javed Ali Khan. Environmental Science & Pollution Research. 28, (2021) 23368–23385 .