

Metal Values from Spent Lithium-Ion Batteries (LIBs) and Fabrication of New LIBs



CRITICAL METAL VALUES OBTAINED AFTER PROCESSING OF BLACK MASS

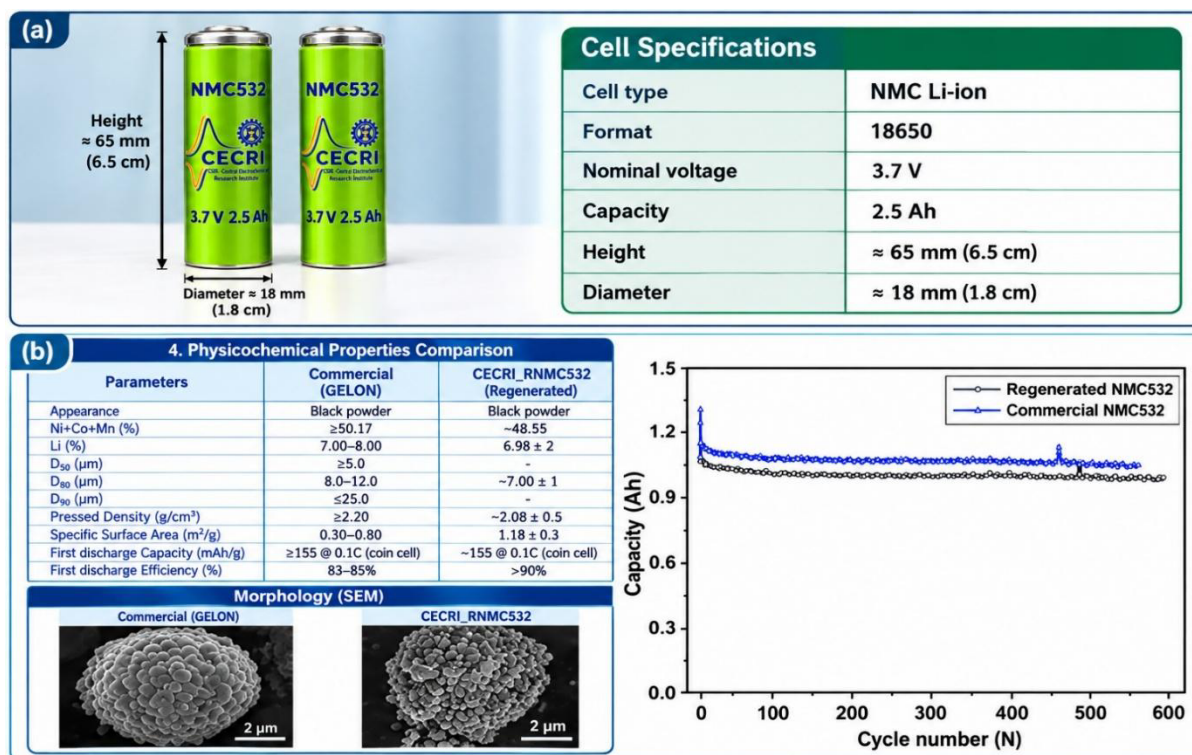


Highlights

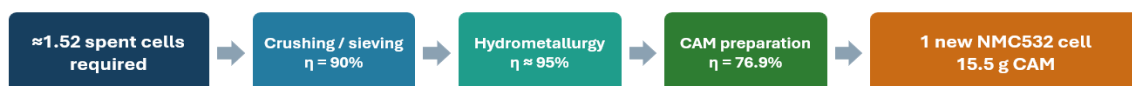
- Black Mass Generation Facility at a scale of 25 kg per day.
- 85-89% and 95% recovery efficiency for Li_2CO_3 and Mixed Hydroxide Precipitate demonstrated at 25 kg (Black Mass) scale.
- Battery-grade Li_2CO_3 (99.95%) and Ni-Co-Mn oxides/sulphates (99.95%).
- By-products: Cu (through Electrowinning), Al-Fe oxides.
- Zero Liquid Discharge Process.
- 1TPD of Black Mass Processing: CAPEX-Investment (14-15 Crores), OPEX: 3.5-5 Lakh, Return on Investment: 48%

Section	Item	Unit	Value
 Plant Details	Capacity	TPD	1
	Operating Days	Days/year	330
	Installed CAPEX	₹ Cr	12-13
	Working Capital	₹ Cr	2
	Total Project Investment	₹ Cr	14-15
 Operating Cost	Black Mass	₹/day	1,20,000
	Chemicals	₹/day	1,40,000
	Power	₹/day	10,000
	Manpower	₹/day	18,000
	Maintenance	₹/day	20,000
	ETP / Compliance	₹/day	15,000
	Total OPEX	₹/day	3,23,000
 Product Revenue	MHP (380 kg @ ₹1,100/kg)	₹/day	4,18,000
	Copper Powder (45 kg @ ₹850/kg)	₹/day	38,250
	Battery-grade Graphite (90 kg @ ₹60/kg)	₹/day	5,400
	Lithium Carbonate (380 kg @ ₹850/kg)	₹/day	1,53,000
	Sodium Sulphate (362 kg @ ₹8/kg)	₹/day	2,896
	Total Revenue	₹/day	6,17,546
 Profitability	Gross Margin	₹/day	2,94,546
	Annual Revenue (330 days)	₹ Cr	20.38
	Annual Gross Surplus	₹ Cr	9.72
	Estimated Payback	Years	~1.5

Lithium-ion batteries fabricated from recycled metal salts (B2B)



From Spent 18650 Cells to a New NMC532 Cell: Recovery and Cost Summary



Overall CAM recovery

65.8%

$$0.90 \times 0.95 \times 0.77 = 0.66$$

$$1 \div 0.66 = 1.52 \text{ spent cells/new cell}$$

Element recovery

Li	85–87 %
Ni, Co and Mn	≈95%
Cu and Fe/Al	94.7–95.2%

Recovered products

50 kg combined Ni-rich + Co-rich black mass

21 kg	MHP
6 kg	Li ₂ CO ₃
1.9 kg	Cu powder
2.48 kg	Fe/Al hydroxides
16 kg	Graphite Leach Residue

Cost per new cell

₹132

Hydrometallurgy	₹32/cell
Cell manufacture	₹100/cell

25 kg pilot basis

9 kg CAM ≈ 560 new cells
Hydromet conversion cost: ₹20,637
Waste generation Na₂SO₄: 155–160 kg

Planning rule: approximately 152 spent cells are required to produce 100 new cells