ISHA'S GMP CONSULTANCY PVT. LTD.
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LACOSAMIDE

API MASS BALANCE / FIVE-STAGE TECHNICAL POSTER

Source basis: uploaded LACOSAMIDE and Summary worksheets | GMP engineering / QA review

TECHNICAL REVIEW COPY
Not an approved GMP batch record

WORKBOOK COVERAGE
2 worksheets
Summary + LACOSAMIDE

SUMMARY BATCH REFERENCE
500 kg
Summary identifies EMPAGLIFLOZIN - verify

DETAILED FINAL OUTPUT
100.00 kg
Lacosamide in Stage 5

DETAILED MANUFACTURING
5 stages
Intermediates are counted in stage totals

SOURCE-DERIVED STAGE FLOW | INTERMEDIATE TRANSFERS

1. **STAGE 1** — Reaction / distillation — 143.94 kg
2. **STAGE 2** — Reaction / layer separation — 151.52 kg
3. **STAGE 3** — Reaction / crystallisation — 166.67 kg
4. **STAGE 4** — Reaction / distillation — 108.33 kg
5. **STAGE 5** — Filtration / drying — 100.00 kg API

FULL STAGE-WISE MATERIAL CHARGES (kg)

Material / source nomenclature	Quantity (kg)
STAGE 1 | REACTION / DISTILLATION	
D-Serine	75.76
Boc-anhydride	173.18
N-methyl morpholine	109.39
Water	303.03
1,4-dioxane	303.03
REPORTED STAGE TOTAL	**964.39**
STAGE 2 | REACTION / EXTRACTION	
Stage-1 intermediate	143.94
Dimethyl sulphate	363.64
Toluene	757.58
NaOH solution 50%	158.64
Hydrochloric acid 2N	166.67
Methylene dichloride	757.58
REPORTED STAGE TOTAL	**2,348.05**
STAGE 3 | REACTION / CRYSTALLISATION	
Stage-II intermediate	151.52
Isobutyl chloroformate	98.18
N-methyl morpholine	87.42
Methylene dichloride	757.58
Benzylamine	77.12
Sodium carbonate 10% soln.	454.55
Water	909.09
Hydrochloric acid 1N	454.55
Cyclohexane	833.33
REPORTED STAGE TOTAL	**3,823.34**
STAGE 4 | REACTION / DISTILLATION	
Stage-III intermediate	166.67
Hydrochloric acid 35%	282.17
Methylene dichloride	1,666.67
NaOH solution 30%	433.33
REPORTED STAGE TOTAL	**2,548.84**
STAGE 5 | FINAL ISOLATION	
Stage-IV intermediate	108.33
Acetic anhydride	60.83
Water	541.67
Sodium carbonate 10% soln.	250.00
Ethyl acetate	500.00
REPORTED STAGE TOTAL	**1,460.83**

FULL STAGE-WISE OUTPUT STREAMS (kg)

Material / source nomenclature	Quantity (kg)
STAGE 1 | REACTION / DISTILLATION	
1,4-dioxane recovery	287.88
1,4-dioxane loss	15.15
Aqueous effluent + salts	513.48
Ethyl acetate recovery	3.94
Organic residue impurities	143.94
REPORTED STAGE TOTAL	**964.39**
STAGE 2 | REACTION / EXTRACTION	
Aqueous effluent + salts	679.09
Toluene recovery	719.70
Toluene loss	37.88
Methylene dichloride recovery	719.70
Methylene dichloride loss	37.88
Organic residue impurities	2.27
Stage-II intermediate	151.52
REPORTED STAGE TOTAL	**2,348.10**
STAGE 3 | REACTION / CRYSTALLISATION	
Aqueous effluent + salts	2,019.24
Methylene dichloride recovery	719.70
Methylene dichloride loss	37.88
Cyclohexane recovery	791.67
Cyclohexane loss	41.67
Organic residue impurities	46.52
Stage-III intermediate	166.67
REPORTED STAGE TOTAL	**3,823.33**
STAGE 4 | REACTION / DISTILLATION	
Aqueous effluent + salts	769.58
Methylene dichloride recovery	1,583.33
Methylene dichloride loss	83.33
Organic residue impurities	4.25
Stage-IV intermediate	108.33
REPORTED STAGE TOTAL	**2,548.83**
STAGE 5 | FINAL ISOLATION	
Aqueous effluent + salts	830.83
Ethyl acetate recovery	475.00
Ethyl acetate loss	25.00
Organic residue impurities	30.00
LACOSAMIDE (FINAL API)	**100.00**
REPORTED STAGE TOTAL	**1,460.83**

RECONCILIATION / QA REVIEW

RECORDED STAGE BALANCES

Stage	IN	OUT	Delta
1	964.39	964.39	+0.00
2	2,348.05	2,348.10	+0.05
3	3,823.34	3,823.33	-0.01
4	2,548.84	2,548.83	-0.01
5	1,460.83	1,460.83	+0.00

FINAL LACOSAMIDE
100.00 kg
Final-stage entry, not 500 kg summary reference

SOURCE-VALIDATION FLAGS

01 Summary!B4 identifies EMPAGLIFLOZIN; detailed worksheet identifies LACOSAMIDE.

02 Summary reference is 500 kg; final Stage 5 product is 100 kg. Basis not explained.

03 Summary and detailed ratio/volume fields contain #REF! errors.

04 Reported output subtotals for Stages 2, 3 and 4 differ from their itemised sums.

05 Stage 1 labels 143.94 kg as organic residue; Stage 2 uses 143.94 kg as intermediate.

06 Stage 1 lists 3.94 kg ethyl acetate recovery without a matched charge in that stage.

DOCUMENT CONTROL / MASS-BALANCE INTERPRETATION

Recorded gross stage totals include repeated intermediate transfers; do not add them as distinct production inputs. Differences and unlinked labels require QA/process-owner reconciliation.

Source: 8- LACOSAMIDE(1).xlsx | No assumed yields, process steps or acceptance limits added | For technical illustration and review only.

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