MCP SERVER | NO CODE | CLOUD HOSTED

Cumene Plant Design Suite MCP

Build precise chemical plant specifications through your AI agent.

Cumene Plant Design Suite is a specialized engineering MCP for designing isopropylbenzene production facilities. It uses alkylation kinetics to handle reactor sizing, catalyst estimation, and yield prediction. You can use it within any MCP-compatible client like Claude, Cursor, or Windsurf to run complex chemical engineering calculations and optimize feedstock ratios for high-purity output.

A+ Quality Score 100/100

chemical-engineering | cumene | alkylation | zeolite | plant-design

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vinkius.com/en/ai-agent-connect/cumene-plant-design-suite

SCAN TO VIEW

The connectivity layer between AI and the world's software.

Vinkius sits between AI and every application. All communication passes through Vinkius Cloud via the Model Context Protocol (MCP) — with governance, observability, and security at every layer.

Your AI Connections Run Through Vinkius Cloud

The world's largest managed MCP catalog

Vinkius is the connectivity layer where AI connects to the software your business already runs. We handle the hosting, the security, the credentials, the uptime — you get agents that actually do things.

We operate the world's largest managed MCP catalog. Major SaaS platforms, CRMs, databases, and cloud providers — running, monitored, production-ready. This MCP server is hosted and maintained by the Vinkius Cloud for AI Agents.

> *The agent doesn't manage credentials, doesn't manage uptime, doesn't manage security. Vinkius does.*
>
> — Architecture principle

Four Pillars of the Vinkius Runtime

01 — Security by design

Credentials stay encrypted at rest via AES-256. The AI agent never touches raw keys — they're injected into a sandboxed V8 isolate at runtime. Actions are logged, and connections have an emergency kill switch.

02 — Built on MCP Fusion

This MCP server was built with **MCP Fusion**, the open-source framework (Apache 2.0) that powers the entire Vinkius catalog. Schema-as-firewall strips undeclared fields, compiled PII redaction runs at zero overhead, and cryptographic lockfiles produce git-diffable audit trails.

03 — Deterministic observability

Eight immutable metrics per endpoint: request volume, p95 latency, error rate, active connections, cost attribution. A live payload feed logs every tool call with mutation detection.

04 — Autonomous operations

Servers are deployed, monitored, and patched autonomously. New capabilities and security patches ship weekly. Zero-downtime deployments ensure continuous availability across all managed MCP servers.

AES-256	Ed25519	24h TTL	V8 Isolate
Encryption at rest	PKI vault signatures	Ephemeral session keys	Sandboxed execution

One Token. Instant Access.

Every MCP server on Vinkius is accessed through a **Connection Token**. Tokens are generated in the cloud dashboard and produce a unique MCP endpoint URL. Paste this URL into any MCP-compatible client — no SDK required.

A single token can serve **multiple AI clients simultaneously**, or you can issue separate tokens per client for granular access control. Each token tracks its own request count, last activity timestamp, and can be individually enabled or revoked.

MCP ENDPOINT

```
https://edge.vinkius.com/{token}/mcp
```

Claude · Cursor · VS Code · Windsurf · Grok · Gemini

Security Is the Architecture

Security in Vinkius is not a feature — it's the foundation of the runtime. The gateway enforces multiple independent protection layers between AI agents and third-party APIs.

01 — Ed25519 PKI Vault

Every workspace has an Ed25519 Master Key. Session keys are generated ephemerally (24h TTL) and signed by the Master Key. Credentials never leave the vault boundary.

02 — V8 Isolate Sandboxing

Tool code runs inside isolated-vm V8 isolates with 64 MB memory caps and per-request timeouts. No filesystem access, no network access except through the SSRF-guarded fetch bridge.

03 — SSRF Guard

All outbound HTTP requests are DNS-resolved and validated before execution. Private IP ranges (10.x, 172.16-31.x, 192.168.x, AWS metadata 169.254.x) are blocked at the network layer.

04 — DLP & PII Redaction

A ResponseGuard pipeline intercepts every tool response. Configurable redaction patterns strip sensitive fields (emails, SSNs, card numbers) before data reaches the AI agent.

05 — Cryptographic Audit Trail

Every request is signed into a SHA-256 hash chain with Ed25519 signatures. Events form a tamper-proof, SIEM-exportable forensic record.

06 — Honeytoken Trap System

Phantom credentials are injected into isolated environments. If a honeytoken is used outside Vinkius infrastructure, the server is quarantined instantly.

Emergency Kill Switch

EU AI Act Art. 14(1) Compliant

The kill switch is an **emergency halt** mechanism — not a simple toggle. When triggered, it executes three actions atomically:

01 — Server deactivated

The MCP server is immediately taken offline across the entire cluster.

02 — All tokens revoked

Every connection token is invalidated. Total lockout — reconnection blocked until new tokens are issued.

03 — WebSocket connections killed

Active connections terminated via Redis pubsub broadcast. Propagates to every runtime node in the cluster.

Full Visibility. Zero Guesswork.

The Vinkius cloud dashboard includes a full MCP Governance suite — real-time analytics and security controls for production AI operations.

Control Plane

KPI dashboard with request volume, latency, success rate, token consumption, and AI-generated operational briefings.

Agent Activity

Which AI clients are connecting, how often, and what they're doing — real-time session tracking.

FinOps

Cost tracking per tool, payload compression savings, budget optimization signals, and consumption trends.

Tool Health

Slowest and most error-prone tools, with actionable root-cause insights and performance baselines.

Firewall & DLP

PII redaction activity, sensitive data protection counters, and security event timeline.

Incident Log

Error trends, failure rates, status-code breakdowns, and forensic audit trail access.

> Get started at **cloud.vinkius.com** — connect your AI agent in under 60 seconds.

Cumene Plant Design Suite MCP

4 tools available
Cloud-hosted on Vinkius

You can now run complex cumene production modeling directly through your AI client. This MCP provides the mathematical backbone needed to design alkylation-based facilities. Instead of manually calculating reactor volumes or catalyst masses, you tell your agent what your target capacity is, and it handles the kinetics.

It covers the full design spectrum, from determining physical reactor specifications to predicting how much PIPB or PDPB you'll actually produce. You can also use it to find the sweet spot for benzene to propylene ratios, ensuring you maximize selectivity while keeping byproducts low. It accounts for the realities of the process, including transalkylation and PDPB removal, so your design models reflect actual plant performance rather than just theoretical ideals.

Core Capabilities

01 — Reactor Sizing

Your agent calculates the necessary physical specifications for alkylation reactors.

02 — Catalyst Estimation

The AI determines the specific mass and type of zeolite catalyst required for the process.

03 — Yield Prediction

Your client predicts the output of cumene and various byproducts like PIPB and PDPB.

04 — Feedstock Optimization

The tool finds the best benzene to propylene molar ratios to maximize selectivity.

One Click on Vinkius — From Prompt to Execution

Available at **vinkius.com/en/ai-agent-connect/cumene-plant-design-suite** — connect your AI agent in three steps.

01 Connect your AI client to the Vinkius hosted MCP.

02 Provide your target production capacity or feedstock amounts to your agent.

03 The agent invokes the specific engineering tool needed for the calculation.

04 Receive precise technical specifications like reactor volume, catalyst mass, or molar ratios.

You connect the MCP to your preferred AI client and start running engineering queries.

Built For

This MCP is built for professionals working in chemical process design and plant engineering.

Chemical Engineers

They use the MCP to run rapid kinetic calculations and reactor sizing models.

Process Designers

They hand off feedstock optimization and catalyst requirement tasks to their AI agent.

Plant Managers

They use yield predictions to estimate production outputs and byproduct levels.

What Changes When You Connect

01 Calculates reactor volumes and residence times using alkylation kinetics.

02 Determines zeolite catalyst mass requirements for specific plant scales.

03	Predicts byproduct levels including PIPB and PDPB.
04	Optimizes benzene to propylene ratios to improve selectivity.

Real-World Applications

Initial Plant Sizing

Determine the necessary reactor volume and catalyst mass for a new cumene production facility.

Yield Forecasting

Predict how much cumene will be produced based on specific transalkylation and PDPB removal rates.

Feedstock Management

Find the most efficient molar ratio of benzene to propylene to minimize waste.

Process Optimization

Adjust design parameters to improve cumene selectivity and product purity.

Patterns to Avoid

Ignoring byproduct formation

AVOID

You only ask for the total cumene output without considering the PIPB or PDPB levels.

✓ INSTEAD

Use `calculate_yield_and_byproducts` to get a full picture of your plant's chemical output.

Guessing catalyst needs

AVOID

You try to estimate zeolite mass based on old plant data instead of current design goals.

✓ INSTEAD

Run `estimate_catalyst_requirements` to get the exact mass and type needed for your specific scale.

Static feedstock ratios

AVOID

You stick to a standard benzene to propylene ratio regardless of how it affects selectivity.

✓ INSTEAD

Use `optimize_feedstock_ratio` to find the specific molar ratio that maximizes your cumene yield.

The Right Fit

Chemical engineers and process designers should connect this MCP to automate kinetic calculations. If you are just looking for general chemical properties without specific plant design goals, this isn't for you. The decision depends on whether you need to model actual reactor performance and feedstock selectivity.

Cumene Plant Design Suite 4 Tools

These tools handle the heavy lifting for alkylation kinetics, reactor sizing, and feedstock optimization.

#	TOOL	DESCRIPTION
01	`calculate_reactor_design`	This tool determines the physical dimensions and specifications of an alkylation reactor based on your target production goals.
02	`calculate_yield_and_byproducts`	Use this to predict the chemical output of your plant, specifically the amounts of cumene, PIPB, and PDPB produced.
03	`estimate_catalyst_requirements`	This tool calculates the exact mass and type of zeolite catalyst your plant needs to function.
04	`optimize_feedstock_ratio`	This tool finds the ideal molar ratio of benzene to propylene to maximize cumene selectivity and reduce unwanted byproducts.

See It in Action

Real prompts you can use once this MCP is connected to your AI agent through Vinkius Cloud.

U Calculate the reactor design for a capacity of 50000 tons per year with 60000 tons of benzene and 30000 tons of propylene available.

The required reactor volume is 125 m3, with a residence time of 2.5 hours and a catalyst mass of 15,000 kg.

U What is the expected yield if I have a target capacity of 10000 units, 0.95 transalkylation efficiency, and 0.98 PDPB removal rate?

The predicted cumene yield is 9,450 units with an overall efficiency of 94.5%.

U Find the ideal benzene to propylene ratio for a target capacity of 20000 with a desired selectivity of 0.98.

The ideal benzene to propylene ratio is 6:1, requiring 120,000 units of benzene and 20,000 units of propylene.

Frequently Asked Questions

01 **What kind of catalyst does this MCP design for?**

The MCP is specifically designed to estimate the requirements for zeolite catalysts used in cumene production.

02 **Which AI clients can I use with this MCP?**

You can use this MCP with any compatible client, including Claude, Cursor, Windsurf, and VS Code.

03 **Can I predict byproduct levels?**

Yes, the tool can predict the chemical output of the plant, including PIPB and PDPB.

04 **Does this MCP handle feedstock optimization?**

Yes, it includes a tool to determine the ideal molar ratio of benzene to propylene to maximize selectivity.

05 **How is the reactor design calculated?**

The reactor design is determined using precise alkylation kinetics to meet your target production goals.

06 **How do I calculate the required reactor size?**

You can use the `calculate_reactor_design` tool by providing your target capacity and the availability of benzene and propylene.

07 **Can I optimize the feedstock to reduce byproducts?**

Yes, the `optimize_feedstock_ratio` tool calculates the ideal benzene to propylene ratio to maximize selectivity and minimize PIPB formation.

08 **Does this tool account for catalyst degradation?**

Yes, `estimate_catalyst_requirements` provides an expected lifespan for the zeolite catalyst based on standard degradation rates.

Go Live in 60 Seconds

Get your connection token from **cloud.vinkius.com**, then paste the endpoint URL into any MCP-compatible client.

YOUR MCP ENDPOINT

```
https://edge.vinkius.com/[TOKEN]/mcp
```

CLIENT	WHERE TO CONFIGURE
Claude AI	Profile → Customize → Connectors → "+" → Add custom connector → Paste endpoint
Cursor	Settings → Features → MCP Servers → "+ Add New MCP Server" → Type: SSE → Paste endpoint
VS Code	Ctrl/Cmd+Shift+P → "MCP: Add Server" → add `"cumene-plant-design-suite": { "url": "…" }`
Windsurf	MCP Settings → `mcp_settings.json` → Add endpoint URL
ChatGPT	Settings → Tools & plugins → Add MCP server → Paste endpoint
Gemini	Extensions → Add MCP Server → Paste endpoint URL

ASK AN AI ABOUT THIS

Let your preferred AI explain this MCP server

- Ask ChatGPT
- Ask Claude
- Ask Perplexity
- Ask Gemini
- Ask Grok

READY TO CONNECT

Cumene Plant Design Suite is live on Vinkius Cloud.

Get your connection token, paste it into your AI agent, and start building. No SDK. No deployment. Just results.

Start at cloud.vinkius.com →

vinkius.com · support@vinkius.com

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Endpoint	`https://edge.vinkius.com/{token}/mcp`

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