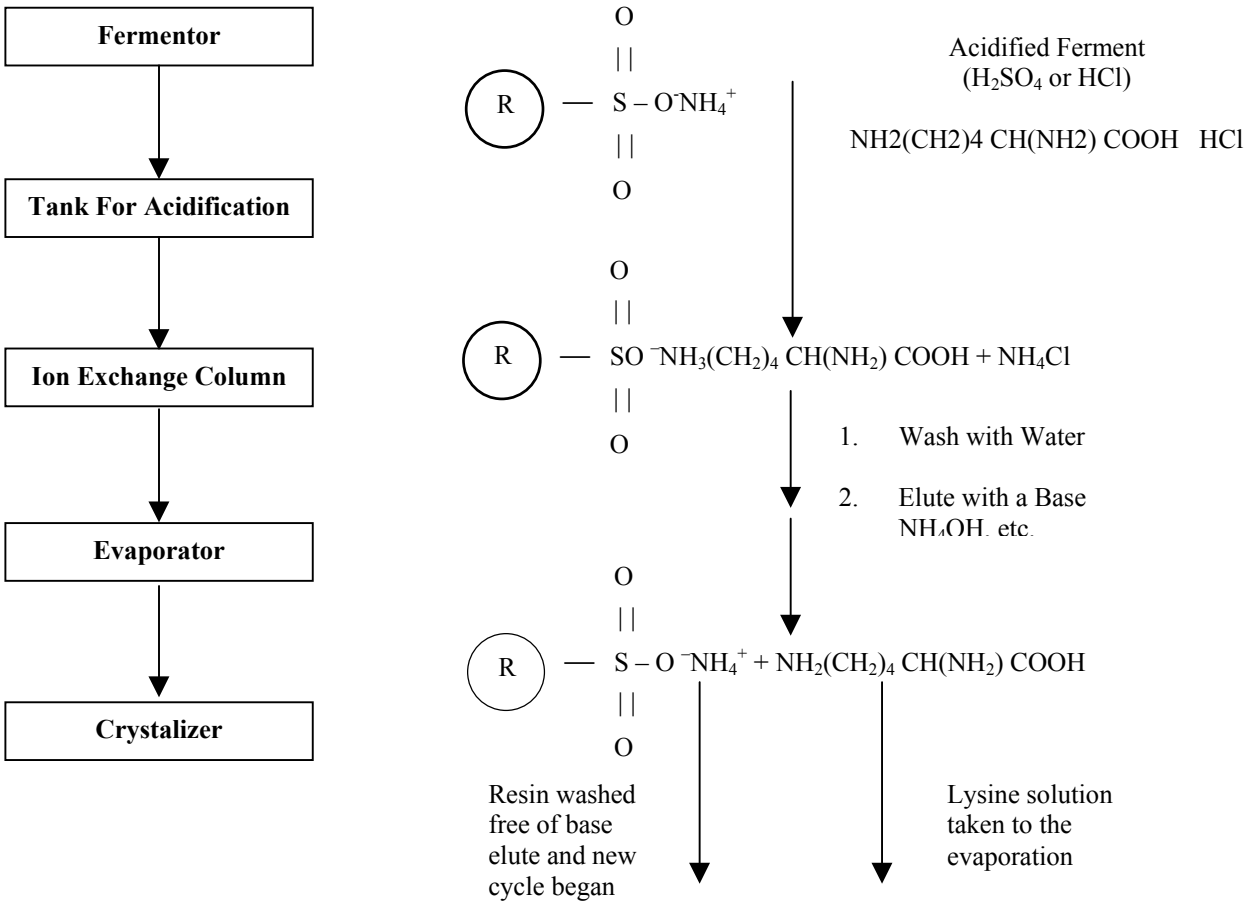
The Recovery of L-Lysine Using Cation Exchange Resins

L-lysine is an essential amino acid produced via fermentation and is a key nutritional supplement for poultry and swine. More than forty different microorganisms have been demonstrated to biosynthesize L-lysine. On the commercial scale almost all production centers around the auxotrophic mutants of Corynebacterum (microcius) glutamicum, bevibacterium ammoniagenes and subtilis (1,2). With small to medium fermentation set-ups L-lysine can be produced to levels of 41-45 grams/liter (3-6). However, for most industrial settings with large scale ferment's (100,000 gallon (380 m^3) vessels) a concentration range of 35-40 grams/liter are more typical (7). Specific operating knowledge, microbe sensitivities, feedstock variations, seasonal temperature changes, and a variety of other effects can affect the amino acid output of a plant. Such variations can not only influence the quantity of the L-lysine produced, but also the amount and type of by-products from which it will need to be separated.

The recovery and purification of L-lysine from a fermented broth has been accomplished by liquid-liquid extraction, precipitation, and cation exchange resins, but only ion exchange is employed industrially (1,8,9). Figure 1, outlines a general scheme by which a gel, cation resin can be employed to recover L-lysine. The cation resin is used in the ammonium (NH_4^+) form. The fermented broth is acidified with hydrochloric or sulfuric acid and then contacted with the resin, with the lysine being retained by the resin. A water wash of the lysine-loaded resin can partially purify the lysine. The product can then be recovered from the resin by elution with ammonium hydroxide, while at the same time regenerating the cation resin back to ammonium form ready for the next product cycle.

FIGURE 1

HOW CATION RESINS ARE APPLIED TO L-LYSINE PRODUCTION



Although a wide variety of gel cation resins will work for most L-lysine recovery operations, a number of issues need to be considered in choosing a resin for the long haul. First, the type of equipment can influence resin choice. For example, when a large fixed bed system is employed with each column being loaded and regenerated over fairly long processing cycles (12 – 24 hours) a standard gel cation can be applied in most cases. But when a continuous resin contacting the system is used with fairly short processing cycles (2 – 4 hours), choosing a more osmotically stable and kinetically efficient resin is indicated. Another key consideration is the broth matrix that is being pumped through the resin bed with the L-lysine. Having a settled or filtered broth can help extend resin bed life due to organic and particulate fouling. If the broth holds an abundance of small peptides, then choosing a more kinetically open resin, such as the DOWEX* N606, offers less potential for fouling over time. Alternatively, if a given broth is fairly clean and holds a high concentration of L-lysine, then a high capacity resin such as DOWEX N406 can yield higher operation through-put per cycle. Dow offers a wide range of cation resins for your L-lysine recovery needs. The attached table is a good starting point.

DOWEX Ion Exchange Products for L-Lysine Recovery

Product	**Description**	**Type**	**Matrix**	**Total Exchange Capacity* eq/l**	**Available Forms**
DOWEX N406	Osmotically strong, high capacity, uniform particle size gel cation resin	Strong Acid Cation	Styrene/DVB Gel 10% cross linked	2.0	H^+
DOWEX MARATHON* C (H^+)	Osmotically strong, uniformed particle size gel cation resin	Strong Acid Cation	Styrene/DVB Gel 8% cross linked	1.8	H^+
DOWEX HCR-S (H^+)	Standard gel cation resin	Strong Acid Cation	Styrene/DVB Gel 8% cross linked	1.8	H^+
DOWEX N606	Kinetically fast, uniformed particle size gel cation resin	Strong Acid Cation	Styrene/DVB Gel 6% cross linked	1.3	H^+

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