BÖLÜM

20

YEM KATKI MADDELERİNİN ÜRETİM TEKNOLOJİLERİ

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GİRİŞ

Hayvan yemlerine katılan yem katkı maddelerinin ve yemlerin kullanılabilirliğini iyileştirmeye yönelik teknolojilerin amaçları; yemlerin besin değerini artırmak, hayvan sağlığını desteklemek ve verimliliği artırmaktır. Söz konusu bu yem katkı maddelerinin üretim teknolojileri, katkının türüne ve işlevine göre farklılık göstermektedir. Yem katkı maddelerinin üretiminde kullanılan teknolojiler, katkının türüne, formuna ve istenen saflık derecesi gibi birçok farklı faktöre bağlı olarak değişiklik göstermektedir. Bu süreçlerde genellikle biyoteknolojik yöntemler, kimyasal sentez ve fiziksel işlemler tek tek veya bir arada kullanılmaktadır.

Yem katkı maddelerinin üretiminde ve yemlerin işlenmesinde kullanılan verimi artırmaya yönelik teknolojiler hayvanların beslenme ihtiyaçlarına uygun, güvenli ve etkili ürünler elde etmek için bilim insanlarınca sürekli değerlendirilmekte ve geliştirilmektedir. Bu süreçlerde kalite kontrolü ve hijyen standartlarına uyum, çevre kirliliği ve sağlığının iyileştirilmesi, hem hayvan sağlığı hem de nihai ürünün kalitesi açısından büyük önem taşımaktadır. Bu bölümde yem katkı maddelerinin elde ediliş süreçleri hakkında bilgiler verilecektir.

Amino Asitlerin Üretim Teknolojileri

Amino asitlerin ilaç, gıda ve yem, kozmetik, polimer malzeme üretimi ve tarımsal kimyasalların üretimi gibi alanlarda kullanımlarının artmasıyla birlikte, amino asit üretimine olan ihtiyaç ciddi bir artış göstermiştir. Fakat amino asit üretimine yönelik endüstriyel süreçlerin hâlâ optimize edilmeye ihtiyacı olduğu bilinmektedir. Bu yüzden, günümüzde gerek özel sektör ve gerekse akademik camia amino asit üretmenin daha uygun maliyetli ve sürdürülebilir yollarını bulmak amacıyla araştırmalar yapmaya devam etmektedir. Hayvan besleme alanında ise özellikle sınırlayıcı amino aitlerden lizin, metiyonin-sistein rasyolara yem katkı maddesi şeklinde sıklıkla ilave edilmektedir. Özellikle başta kanatlı sektörü olmak üzere, süt sığırlarında özelikle de yüksek süt verimine sahip elit sığırlarda by-pass amino asit şeklinde kullanılmaktadır.

Günümüzde amino asitler, genel olarak fermentasyon ve kimyasal sentez yöntemiyle üretilmekle birlikte; bu yöntemlere ek olarak protein hidrolizatlarından ekstraksiyon, ve mikrobiyal işlemler (enzimatik sentez ve fermentasyon) gibi farklı yollarla da üretilmektedirler.

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Koaservasyon (Coacervation): Özellikle protein-polimer kombinasyonlarıyla yüksek yükleme oranı sağlar. Koaservasyon, homojen bir polimer çözeltisinin polimer açısından zengin bir faza (koaservat) ve zayıf polimer fazına (denge fazı) kısmi bir desolvasyonudur. Koaservasyon esas olarak iki kategoriye ayrılır: Basit koaservasyon ve kompleks (karmaşık) koaservasyon. Her iki proseste de mikrokapsül oluşum mekanizması, faz ayrımının gerçekleştirilme şekli dışında aynıdır. Basit koaservasyonda faz ayrımı için bir desolvasyon maddesi eklenirken; karmaşık koaservasyon iki zıt yüklü polimer arasındaki etkileşimi içerir.

Karmaşık koaservasyondaki temel adımlar 1) iki polimerin çözeltisinin hazırlanması; 2) emülsiyon oluşturmak için lipofilik çekirdeğin bir polimer çözeltisiyle karıştırılması; 3) başka bir polimer çözeltisinin karıştırılması; 4) iki karışmayan fazın oluşumunu sağlamak için pH veya sıcaklığın değiştirilmesi; 5) çekirdeğin etrafına koaservatların biriktirilmesi ve 6) çapraz bağlama veya ısı uygulamasıyla kaplamanın sertleştirilmesini içerir.

Dahil Etme Kompleksi (Inclusion complexation): Siklodekstrin kullanımıyla moleküler düzeyde bir kapsülleme yöntemidir. Bu teknik, β-siklodekstrinin tipik olarak kapsülleme matriksi olarak kullanıldığı moleküler düzeyde gerçekleşir. Siklodekstrin molekülünün dış kısmı hidrofilik, iç kısmı ise hidrofobiktir. Apolar olan biyoaktif çekirdekler, hidrofobik bir etkileşim yoluyla apolar iç boşluğa hapsedilebilir. β-Siklodekstrin molekülleri, merkez boşluğuna (yaklaşık 0,65 nm) boyutsal olarak sığabilen bileşiklerle inklüzyon kompleksleri oluşturur. Bu kompleksler, yalnızca suyun varlığında gerçekleşen bir reaksiyonda oluşur. Komplekse, sudan daha az polar olan ve siklodekstrinin iç kısmına sığacak uygun moleküler boyutlara sahip moleküller (örneğin tat maddeleri) dahil edilebilir.

İyonotropik Jelleşme (Ionotropic gelation): Bu metotta iyonik etkileşimle jel küreler oluşturulur. İyonotropik jelleşme, iyonik bir polimerin zıt yüklü iyonla etkileşime girmesiyle oluşur ve bu etkileşim sonucunda ikisi arasında kompleksleşme ve çapraz bağlanma meydana gelir. Ortaya çıkan ürüne jelisfer de denir. Bu jelisferler, simüle edilmiş biyolojik sıvılarda yoğun şişmeye uğrayabilen çapraz bağlı ve küresel hidrofilik polimerik parçacıklardır. Bu yöntem, nötrasötik (gıdada bulunan temel besin değerine ek olarak ekstra sağlık yararları sağlayan, gıda kaynaklarından elde edilen ürün) ve farmasötik ürünlerin kapsüllenmesinde yaygın olarak kullanılmaktadır.

Sonuç olarak, hayvan beslemede kullanılan yem katkı maddelerinin üretiminde öğütme gibi fiziksel işlemler yanında kimyasal yöntemler ve fermentasyon ve ekstraksiyon yöntemleri yaygın olarak kullanılan teknolojiler olarak karşımıza çıkmaktadır. Bunların dışında yem maddelerinin değerini artırma veya raf ömürlerini uzatmaya yönelik nano-teknoloji ve enkapsülasyon yöntemleri de hayvan beslemede karşımıza çıkan teknolojik uygulamalar arasında yer almaktadır.

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