O‘ZBEKISTON RESPUBLIKASI
OLIY TA‘LIM FAN VA
INNOVATSIYALAR VAZIRLIGI

FERGANA
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O‘ZBEKISTON RESPUBLIKASI
FANLAR
AKADEMIYASI

«ZAMONAVIY TEXNOLOGIYALAR VA BARQAROR RIVOJLANISH: MUAMMOLAR VA YECHIMLAR» MAVZUSIDA RESPUBLIKA ILMIY-AMALIY ANJUMAN

MATERIALLARI TO‘PLAMI

FARG‘ONA – 2025

O‘ZBEKISTON RESPUBLIKASI OLIY TA’LIM, FAN VA INNOVATSIYALAR VAZIRLIGI

FARG‘ONA DAVLAT TEXNIKA UNIVERSITETI

ZAMONAVIY TEXNOLOGIYALAR VA BARQAROR RIVOJLANISH: MUAMMOLAR VA YECHIMLAR

mavzusida

respublika ilmiy-amaliy anjumani

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2025-yil

м)								
0,25	5,0	17,83	30,00	9,74	12,50	6,63	3.99	1,80
0,20	24,75	17,56	26,90	9,67	11,44	6,24	4,20	2,24
0,16	34,5	17,99	35,80	9,69	13,87	6,27	3,55	1,89
0,10	32,25	18,00	35,20	10,08	12,27	6,50	4,21	2,23
0,05	3,5	19,48	30.50	9,78	15,28	6,78	3,98	1,99

Shuningdek, suvda eruvchan P_2O_5 miqdorining sezilarli darajada o‘sishi kuzatildi. Fosfatlarning eruvchan shaklga o‘tishi ularning agronomik qiymatini belgilovchi asosiy faktor bo‘lib, o‘simliklar tomonidan tezroq va samaraliroq o‘zlashtirilishini ta’minlaydi. Bu jarayon ayniqsa mayda fraksiyalarda faol kechib, fosforitlarning biologik samaradorligini sezilarli oshiradi.

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ETHYLCELLULOSE-MODIFIED UREA GRANULES AND THEIR SOLUBILITY CHARACTERISTICS

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Annotation: *Urea is a widely used nitrogen fertilizer, but its rapid solubility leads to nitrogen losses. To overcome this limitation, urea granules were modified with ethylcellulose as a coating polymer. The study investigates the dissolution time, mechanical strength, hygroscopic point, pH, density, and viscosity of the modified urea granules. Results indicate improved efficiency, controlled release, and higher storage stability.*

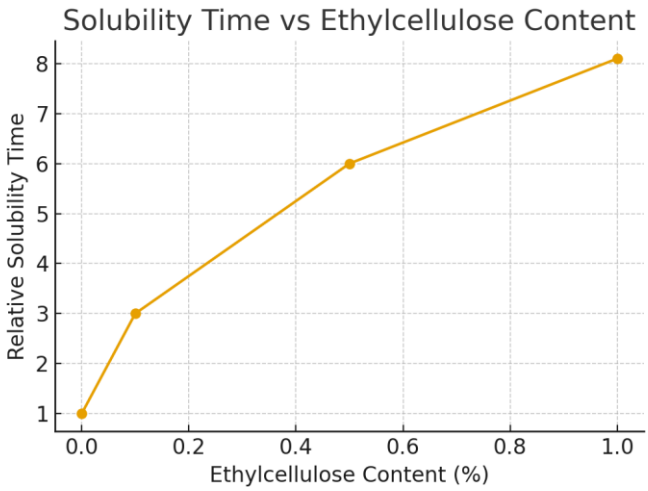
Keywords: Urea*, Ethylcellulose, Fertilizer, Controlled release, Solubility, Granules*

Urea contains 46% nitrogen and is the most commonly applied nitrogen fertilizer worldwide. However, its high solubility causes rapid nitrogen leaching, reducing fertilizer efficiency and polluting soil and water. Controlled-release fertilizers (CRFs) provide a solution by coating urea granules with polymers, slowing the release of nutrients. In this study, ethylcellulose (EC) was used as a modifying polymer to improve dissolution behavior and physical properties of urea granules.

Urea granules were heated to melting temperature and mixed with ethylcellulose in ratios ranging from 0.1 to 1.0%. The modified granules were tested for dissolution time in water, mechanical strength, hygroscopic point, pH, density, and viscosity. Analytical methods included gravimetric analysis for dissolution, compression tests for strength, and standard laboratory techniques for pH, density, and viscosity.

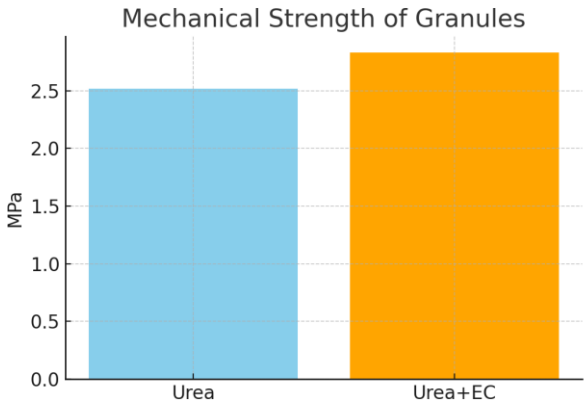
The incorporation of ethylcellulose significantly increased the dissolution time of urea granules. With 1.0% EC, the dissolution time was extended up to 8.1 times compared to unmodified urea.

Figure 1. Solubility time as a function of ethylcellulose content.



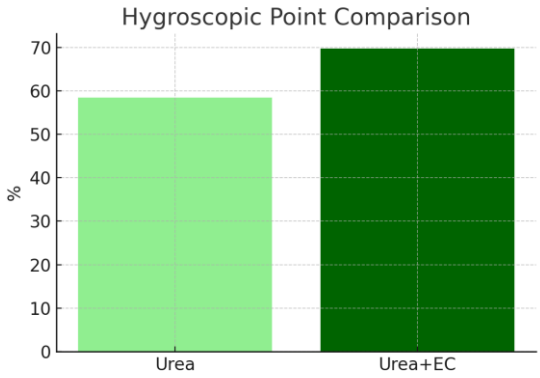
Mechanical strength was also enhanced by EC addition. Unmodified urea granules had an average strength of 2.52 MPa, while EC-modified granules reached 2.83 MPa.

Figure 2. Mechanical strength comparison of granules.



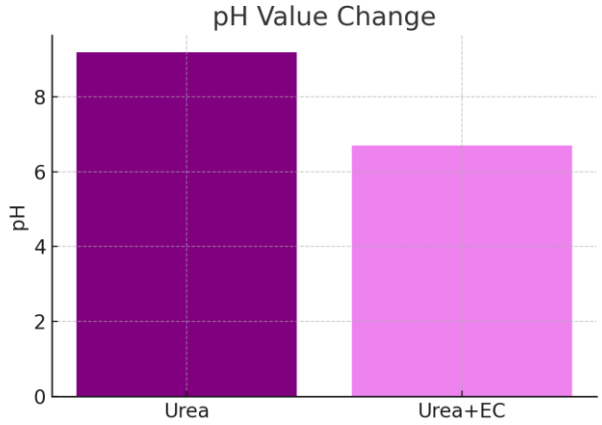
The hygroscopic point of urea increased from 58.4% to 69.7% after modification, indicating better resistance to moisture absorption.

Figure 3. Hygroscopic point comparison.



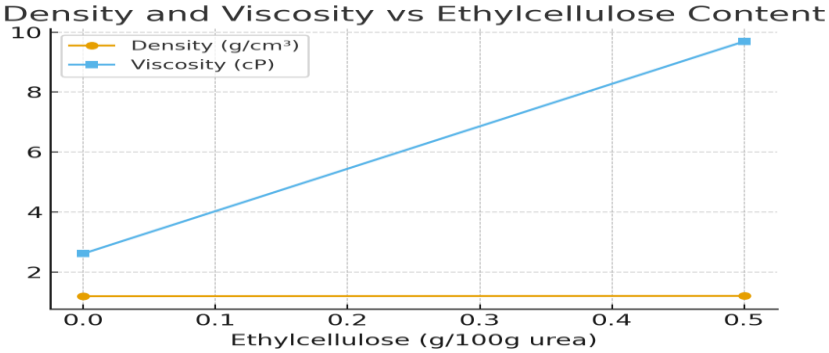
The pH value decreased from 9.18 in pure urea to 6.69 in EC-modified granules, showing reduced alkalinity and potential environmental benefits.

Figure 4. pH value change after modification.



Density slightly increased from 1.20 to 1.21 g/cm³, while viscosity increased more significantly from 2.62 to 9.69 cP, indicating structural changes caused by EC addition.

Figure 5. Density and viscosity with ethylcellulose content.



Ethylcellulose-modified urea granules demonstrated improved dissolution control, mechanical strength, and moisture resistance, while lowering alkalinity. These properties suggest enhanced fertilizer efficiency and environmental safety. Such modified fertilizers can contribute to sustainable agriculture by reducing nitrogen losses.

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