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The “Journal of Transport” publishes the most significant results of scientific and applied research carried out in universities of transport profile, as well as other higher educational institutions, research institutes, and centers of the Republic of Uzbekistan and foreign countries.

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Tashkent State Transport University had the opportunity to publish the scientific-technical and scientific innovation publication “Journal of Transport” based on the Certificate No. 1150 of the Information and Mass Communications Agency under the Administration of the President of the Republic of Uzbekistan. Articles in the journal are published in Uzbek, Russian and English languages.

CONTEXT / MUNDARIJA

Studying the properties of cement concrete with complex additives based on modern superplasticizers and fillers

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Abstract: This article describes the methods of using cement concrete with complex additives today. In modern construction, information is given on the effective ways of using chemical additives to enhance the high physical-mechanical and performance properties of new-generation concrete.
Keywords: Superplasticizer, complex additives, concrete, polycarboxylate esters, zolo-unos, steel melting waste.

Kompleks qo‘shimchali syement betonlarining zamonaviy superplastifikatorlar hamda to‘ldiruvchilar asosidagi xossalarini o‘rganish

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Annotatsiya: Ushbu maqolada xozirgi kunda kompleks qo‘shimchali syement betonlaridan foydalanish usullari ko‘rsatib o‘tilgan. Zamonaviy qurilishda yangi avlod betonlarining yuqori fizik-mexanik va ishlash xossalarini kuchaytirishda kimyoviy qo‘shimchalardan qo‘shib foydalanishning samarali yo‘llari xaqida ma’lumot berilgan.
Keywords: Superplastifikator, kompleks qo‘shimchalar, beton, polikarboksilat efirlari, zolo-unos, po‘lat eritish chiqindilari.

1. Kirish

Zamonaviy qurilishda yangi avlod betonlarining yuqori fizik-mexanik va ishlash xossalarini kuchaytirishda kimyoviy qo‘shimchalardan qo‘shib foydalanmasdan tasavvur qilish mumkin emas. Qurilishda bunday kompozitsiyalar va ular asosidagi mahsulotlarni ishlab chiqarish uchun reologik xususiyatlarga ta’sir qilish, strukturaning shakllanishi va havo kirish jarayonlarini nazorat qilish imkonini beradigan keng turdagi qo‘shimchalar qo‘llaniladi[1-3].

Xozirgi kunda kompleks qo‘shimchali syement betonlaridan foydalanish avvalgiga davrlarga nisbatan sezilarli ko‘paygan. Mahalliy va xorijiy olimlarning izlanishlari natijasida shu narsa mu’lum bo‘ldiki, syement kompozitlarining xususiyatlariga sezilarli ta’sir ko‘rsatadigan va uning xossalarini o‘zgartiradigan eng samarali omil plastiklashtiruvchi qo‘shimchalardan foydalanishdir [3-6].

Shuningdek, bunday muammolarni hal qilishda komleks qo‘shimchali syement betonlarini xossalarni nazorat qilish va kerakli xossa ko‘rsatkichlariga ega bo‘lgan kompozitlarni yaratishda mineral to‘ldiruvchi moddalardan foydalanish xam samara beradi [4-6]. Syement-betonning tuzilishiga ta’sir qilish xususiyatiga ko‘ra, mineral to‘ldiruvchi moddalar faol va inert turlarga bo‘linadi. Quruq issiq iqlim shaoitida ishlatiladigan kompleks qo‘shimchali syement betonlarini tayyorlashda muhim ahamiyat kasb etadi.

Oxirgi vaqtlarda kompleks qo‘shimchali syement betonlarini tayyorlashda polikarboksilat efirlari asosidagi moddalar keng qo‘llanilmoqda. Ushbu superplastifikatorlar boshqa turdagi kimyoviy qo‘shimchalardan syement tizimiga sterik ta’siri bilan ajralib turadi va gidratlangan muhitda sodir bo‘ladigan fizik-kimyoviy o‘zaro ta’sirlar va o‘zgarishlar jarayonini kuzatishga imkon beradi [3-6].

Kompleks qo‘shimchali sement betonlarini tayyorlashda mikroto‘ldirgichlardan foydalanishning ta’siri quyidagicha tushuntiriladi [7-9]:

- faol qo‘shimchalar kalsiy oksidi bilan reaksiyaga kirishadi syement bog‘lovchi yopishtiruvchi-yopishqoq kuchli ulanishlarni yaxshilash orqali amalga oshadi, bu "bog‘lovchi +to‘ldiruvchi" interfeysidagi o‘zaro ta’sirlar ishlab chiqilgan kompozisiyani sezilarli darajada mustahkamlash uchun qulay sharoit yaratadi;
- inert mineral qo‘shimchalar, asosan, betonning zichligi oshirish g‘ovaklar sonining sezilarli darajada kamayishini ta’minlaydi. Bundan tashqari, to‘ldiruvchilarning zarrachalari shartli ravishda yopiladi.

Olimlarning olib borilgan ilmiy izlanishlar shuni ko‘rsatdiki, yuqori sifatli betonlarini olish uchun kimyoviy yoki mineral qo‘shimchalarni alohida emas, balki kompleks shaklda ishlatish ancha samarali ekanligi aniqlandi [2-5]. Bundan tashqari, qo‘shimchalardan foydalanishga bunday kompleks yondashuv ham bog‘lovchining o‘rtacha iste’moli bilan yuqori sifatli betonlarni ishlab chiqishga imkon beradi.

Shu nuqtai nazardan, turli xil tabiatdagi to‘ldiruvchi moddalari bilan murakkab qo‘shimchali syement betonining asosiy fizik-mexanik xususiyatlarini o‘rganish berilgan.

2. Tadqiqot metodologiyasi

Eksperimental tadqiqotlarda Oxangaron sement zavodining M400 D0 markali portlandsyementidan foydalanilgan. Mineral to‘ldiruvchi sifatida YangiAngren IYeS dan uchuvchi kul (UK) va Toshkent quyuv-mexanika zavodining (TQMZ) po‘lat eritish chiqindilari (PECh) ishlatilgan. Sirtli faol modda sifatida, polikarboksilat superplastiklashtiruvchi (SP) POLIMIKS ishlatilgan.

Tadqiqot o‘tkazish uchun uchta turdagi kompozisiyalarning bir qator namunalar tayyorlandi: nazorat va kompleks qo‘shimchali (1-jadval).

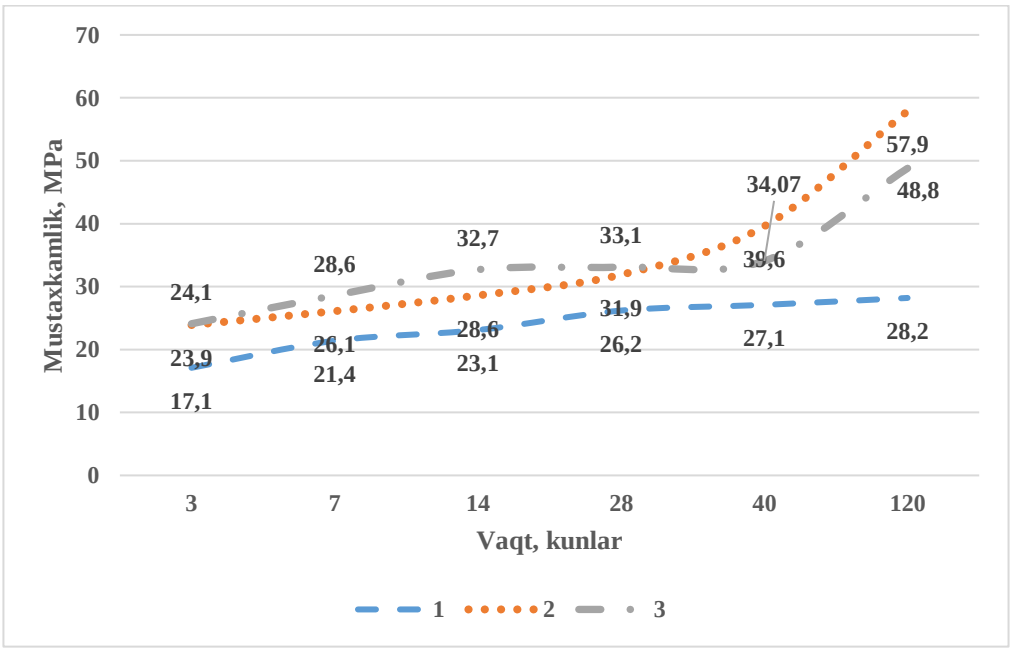
1-jadval

Beton qorishmasining o‘rganilganlik tarkibi

	Beton sinfi	Konus cho‘ kishi, sm	Syement, kg	Maydalangan tosh, kg fr. 5-20	Qum, kg M_{cr}=2,7	Suv, l	Zolo-unos, kg	Po‘ lat ishlab chiqarish chiqindilari, kg	Superplastifikator POLIMIKS, kg
	B15	1-2	236	1220	715	190	-	-	-
	B15	1-2	201	1220	792	133	35	-	1.89
	B15	1-2	201	1220	792	133	-	35	1.89

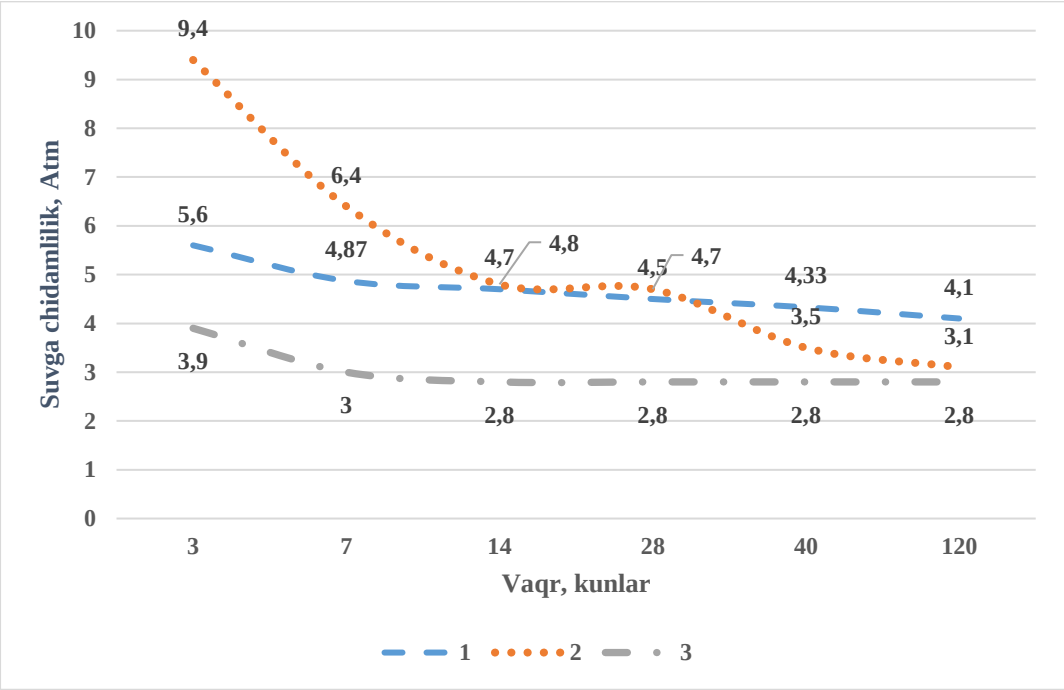
Namunalarning siqilishga mustaxkamligi, zichligi, suvga chidamliligi, suvni singdirish kabi fizik-mexanik xususiyatlarini o‘rganish standart usullar asosida amalga oshirildi. Beton namunalarini qattiqlashtirish normal sharoitda amalga oshirildi va 3, 7, 14, 28, 40, 120 sutkalik sinovdan o‘tkazildi.

1-rasm shuni ko‘rsatdiki, dastlabki 3 sutka ichida har xil turdagi to‘ldiruvchi moddalari bo‘lgan murakkab qo‘shimchali kompozisiyalarning mustahkamlik xususiyatlari deyarli bir xil va nazorat tarkibi 28 % ga oshadi. 14 sutkalikda PECh+SP tarkibining kuchi ZU+SP modifikatori bilan to‘ldiruvchiga nisbatan 8-12 % va nazorat tarkibi 25-28 % ga oshadi. Ushbu ko‘rsatkichga ko‘ra, beton sinfi B25, etalon esa B15 sinfga taaluqli bo‘ladi.



1-rasm. O‘rganilayotgan tarkibning siqilishga mustahkamligi tekshirish: 1-nazorat; 2-ZU+SP; 3-SP+PECH

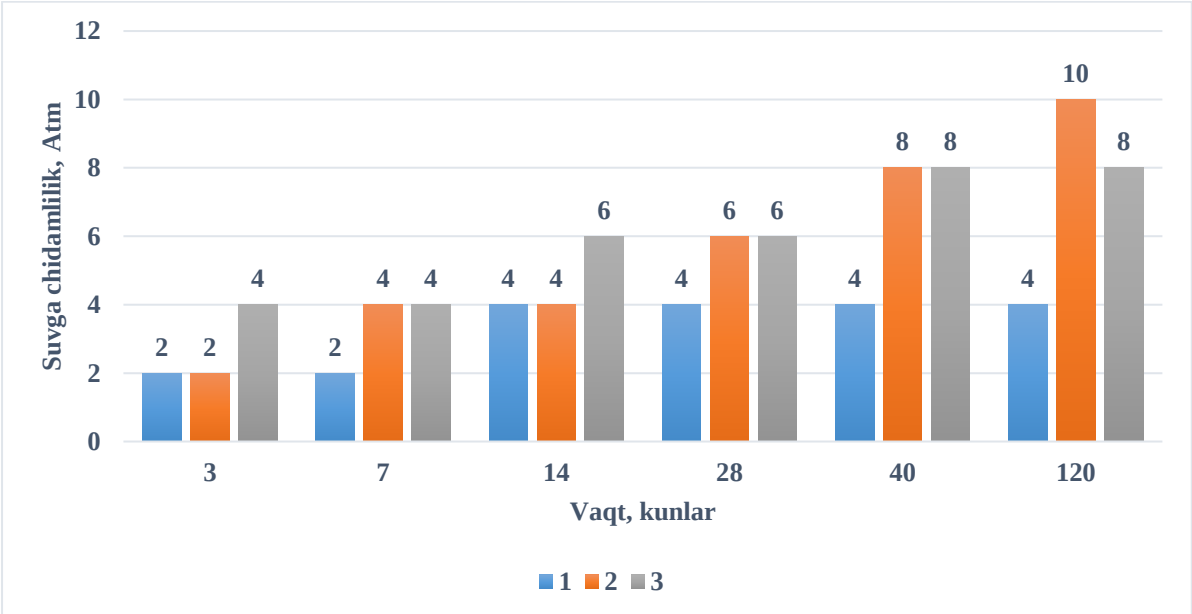
Bizning fikrimizcha, tashqi ta’sir va to‘ldiruvchi moddalar, ularning kiritilishi, bir tomondan aralashtirish vaqtidagi suv miqdorini kamayishi boshqa tomondan, mikroto‘ldiruvchilar va puzolan faolligini oshishi modifikasiyalangan to‘ldirgichlarning mustahkamligining sezilarli darajada oshishiga sabab bo‘ladi.



2-rasm. O‘rganilayotgan tarkibning suv o‘tkazuvchanligini tekshirish:
1-nazorat; 2-ZU+SP; 3-SP+PECH

Tadqiqotlar shuni ko‘rsatdiki, kompleks qo‘shimchalar qotayotgan betonning suv shimuvchanligiga turlicha ta’sir ko‘rsatadi (2-rasm). O‘rganilayotgan tarkiblardan ZU+SP 14 sutkalik qotishda boshqa tarkiblarga qaraganda eng ko‘p suv shimuvchanlikni namayon qildi.

Bu tarkibdagi ikkilamchi g‘ovaklikni hosil qiluvchi erkin, to‘liq yonib ketmagan ko‘mir zarralarining mavjudligi bilan bog‘liq. Tadqiqotlarimiz shuni ko‘rsatdiki, o‘rganilayotgan g‘ovaklar asosan yopiq g‘ovaklar ekanligi aniqlandi va ular materialning o‘tkazuvchanligiga ta’sir o‘tkazmaydi (3-rasm). Eng kam suv shimuvchanlikni SP+PECH tarkibi ko‘rsatdi. Yuqorida ta’kidlanganidek bu holat katta g‘ovaklarning kichik zarralar bilan to‘sib qo‘yish orqali yuzaga keladi.



3-rasm. Tarkiblarning suvga chidamliligini o‘rganish:
1-nazorat; 2-ZU+SP; 3-SP+SPO

Suv o‘tkazmaslik usulini o‘rganish shuni ko‘rsatdiki, murakkab modifikatorlardan foydalanish g‘ovaklik tuzilishini yaxshilaydi, g‘ovaklar orqali bloklanadi, katta kapillyarlarning hajmini kamaytiradi va ularni geliyga aylantirishga olib keladi.

3. Xulosa

Bunday o‘zgarishlar natijasida kompozitsiyaning zichligi oshishi ta’minlanadi va natijada mustaxkamlik ta’minlanadi. Tadqiqotlardan ma’lum bo‘ldiki, eng yuqori mustaxkamlik chegarasiga 40 sutkalik muddatdan keyin erishildi. Shuni alohida ta’kidlab o‘tish joizki, ko‘rib chiqilayotgan qo‘shimchalardan pussolan reaksiyaga eng yaxshi zolo-unos kirishdi. 120 sutkalik qotishdan so‘ng ZU+SP tarkibi 57.9 MPa mustaxkamlikka erishdi. Bu natija o‘z navbatida PECH+SP tarkibidan 15 % ga, etalon tarkibdan esa 51 % ga ko‘p demakdir.

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